Mathematics Without Borders

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Mathematics Without Borders

A History of the International Mathematical Union

With 55 Illustrations

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Preface

At its meeting in April 1990 at the University of Cambridge, the Executive Committee of the International Mathematical Union (IMU) decided that the largely unorganized archives of the Union should be properly arranged and catalogued. Simultaneously, the Executive Committee expressed the wish that a history of the Union should be written [1].

As Secretary of the Union, I had proposed that these issues be discussed at the Cambridge meeting, but without having had in mind any personal role in the practical execution of such projects. At that time, the papers of the IMU were stored in Zurich, at the Eidgenössische Technische Hochschule, and I saw no reason why they could not remain there. At about this time, Professor K. Chandrasekharan produced a handwritten article titled "The Prehistory of the International Mathematical Union" [2], and it seemed to me that this might serve as the beginning of a more comprehensive history.

I had first thought that Tuulikki Mäkeläinen, who during eight years as the Office Secretary of the IMU had become well acquainted with the Union, would do the arranging of the archives in Zurich. She had a preliminary look at the material there, but it soon became clear that the amount of work required to bring order to it was too great to be accomplished in a few short visits from Helsinki. The total volume of material was formidable. Some of it was irrelevant and should be discarded to make the files more accessible. And it would be no insignificant task to organize the remaining papers. It appeared that work on the IMU papers would not progress in Zurich.

By coincidence, under construction at the time was a new storage area for the archives of the University of Helsinki. Located beneath the University Main Building, the rooms, which were inaugurated in 1993, were technically advanced, with maximum security and sophisticated climate control. The new archives represented such a substantial increase in storage capacity that vast stretches of empty shelves beckoned.

Jürgen Moser, the President of the Union from 1983 to the end of 1986, who supervised the IMU archives in Zurich, had asked me some years earlier whether the IMU material might be collected and brought to Helsinki. I had rejected the idea then, but in view of the improved facilities in Helsinki and the deadlock in Zurich, I began to have second thoughts. Having received a green light from the head of the archives of the University of Helsinki, I informed Jacob Palis Jr., the Secretary of the Union, about the Helsinki option.

In the spring of 1994, the IMU Executive Committee made the decision to move the IMU material from Zurich to Helsinki [3]. In September 1994, fourteen mail sacks, weighing in at twenty kilos each, arrived in Helsinki. The files from the eight-year period 1983–1990 were already there. In October 1994, Tuulikki Mäkeläinen and I began work on organizing the material, and the task was completed in June 1996 (Fig. 1). A summary of the contents of the archives is presented in the Appendix, Section 13.

In informing me that the Union was pleased to see its archives in the hands of the University of Helsinki, Palis, representing the Executive Committee, asked me to write the history of the IMU. I hesitated for a few months, but after discussions with Chandrasekharan, whose literary interests had turned from history into more mathematical topics, I answered in the affirmative.

It soon became clear that work with the Union's history fell into two distinctly different parts. There was not a single document in the IMU archives from the years before 1952, i.e., prior to the first General Assembly of the new Union. Thus, an essential part of my work dealing with the prehistory, the old IMU, and the preparations leading to the new IMU consisted in attempts to uncover source material. Two years' search produced a substantial quantity of relevant papers, but not all that I had hoped to find. It may well be that the discovery of more source material would shed additional light on the history of the old IMU.

In contrast to the years before 1952, the volume of archival material covering the new Union is overwhelming. The Bulletins of the IMU and the reports and minutes of the meetings of the General Assemblies and Executive Committees have been well preserved. Yet closer scrutiny revealed that the collection was not complete. Secretarial correspondence was abundant, but it exhibited considerable variation, and presidential correspondence had been stored only in part. From my investigations into the history of the IMU, I formed an idea of pertinent papers that should have been in the files. Those that could be located have been added to the archives.

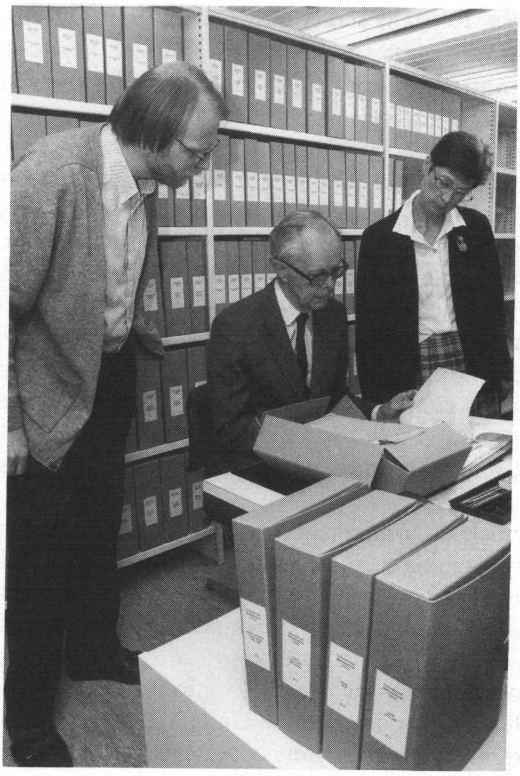

FIGURE 1. IMU Archives in 1996. Chief Archivist Eero Vallisaari, Olli Lehto, and Tuulikki Mäkeläinen. The past of the IMU through 1991 is stored in the Central Archives of the University of Helsinki in 125 boxes. Photo: Ilmar Jöutvald.

The reports of the Executive Committees, coupled with the minutes of the General Assemblies, provide a chronological list of the Union's main events since 1952. These documents formed the natural backbone for my writing on the new IMU. However, if that was all there was, the result would be little more than a skeleton, without much life. Thanks to numerous less formal letters written at the time, I hope to have increased readability without having made concessions to reliability. Relatively ample coverage has been given to the difficulties that the IMU encountered, because they often illustrated the values and attitudes prevailing in the Union and in the international mathematical community.

Aside from mathematical events, international politics are a pervasive feature in my history of the IMU. The aftermaths of the First and Second World Wars and the repercussions of the Cold War are inseparably entangled with the history of the IMU. Clemenceau, Hitler, Mussolini, Stalin, MacArthur, Khrushchev, Chiang Kai-shek, Mao Zedong, Brezhnev,

Jaruzelski, Wałęsa, Reagan, and Gorbachev figure in the text alongside the mathematicians. Whatever the effects of political events on the progress of mathematics and the work of the IMU, they have certainly made the Union's history more interesting.

This book is not a history of mathematics in the twentieth century. Of course, it is not completely divorced from it either. The invited lectures of the International Congresses of Mathematicians (ICM), which are now entirely the responsibility of the IMU, reflect the state and progress of mathematics every fourth year. The Fields Medals and the Rolf Nevanlinna Prize, additional IMU responsibilities, reflect current opinion on the most significant mathematical achievements at the time they are awarded. Backstage information about the screening of the candidates for these lectures and awards is contained in the files of the IMU Program and Prize Committees. However, these papers are not yet available. By a decision of the Executive Committee such documents are to remain sealed for sixty years.

The ICMs, which determine the rhythm of the life of the IMU, are discussed, but the discussion does not enter into detail about their mathematical content. The invited lectures and surveys of the works of the Fields Medal and Nevanlinna Prize winners can be read in the Congress Proceedings.

This book covers events of the IMU through the end of 1990, when I resigned the office of Secretary of the Union. This time limit is not unconditional. For example, there is some commentary on later developments of projects that were launched prior to 1991.

The question may, then, be asked why this history of the IMU has been written. The classical answer is to express hope that some lessons might be drawn from it, that the record of past events might serve as a guide for the future. *In historia semen futuri.*

A more concrete justification for the creation of this book is the fact that the IMU is not particularly well known among mathematicians. The Union is often blamed for its poor visibility, accused of being an institution that in secretive ways steers the fate of the international mathematical community. I hope that this history will improve understanding of the important role the Union has played in the promotion of mathematics throughout the world.

Finally, this is a story of how ideas of the global cultivation of mathematics, across national borders, gradually began to take shape a century ago and how these ideas developed, amidst political difficulties and serious setbacks, into a fruitful worldwide cooperative effort under the aegis of the IMU. I hope the reader will find the history of the International Mathematical Union to be of interest.

Helsinki, Finland — Olli Lehto

Acknowledgments

This history was written at the request of the 1991–1994 Executive Committee of the International Mathematical Union. I am greatly obliged to the Committee for the confidence placed in me, and I extend my thanks in particular to Jacques-Louis Lions and Jacob Palis, who were then the Union's President and Secretary. The encouragement from Past President Jürgen Moser was conducive to my affirmative answer.

Many colleagues and friends around the world have in some way or other contributed to my work. I am deeply grateful to all of them. Their total number is so large that I cannot, I regret, express my gratitude to them here individually. I also mention with appreciation the continual assistance from the Library of the Mathematics Department of the University of Helsinki and the efficient help I received in libraries and archives in Britain, France, Germany, and Sweden.

Grants from the Finnish Academy of Science and Letters, through the Finnish Mathematical Society, and from the International Mathematical Union covered various expenses. Thanks to the secretarial assistance of Tuulikki Mäkeläinen, I was relieved of a large amount of work.

Finally, I have greatly profited from cooperation with the publisher. The expert guidance of Ina Lindemann, Gerald Alexanderson, and David Kramer has been very important.

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Prologue to the History of the IMU

The International Mathematical Union was founded in 1920. Long before its establishment, there had been organized international mathematical cooperation. Joint work in the field of bibliography had already begun in the 1870s, and International Congresses of Mathematicians with well-defined rules and objectives had been held regularly since 1897. Once founded, the task of the IMU was to find an appropriate role in the existing cooperation and to enhance and expand it. Success was ultimately achieved, but not until after the Second World War.

The origins of the IMU are connected with the general developments in the world that have been reflected in the scientific community. During the nineteenth century the scientific ambiance changed dramatically. In the early 1800s, the number of scientists in each discipline was small, and there were only a few journals in which their results appeared. The French Revolution and the Napoleonic wars reshaped the social class structure in Europe. The greatly strengthened middle class showed increasing interest in the advancement of science and technology, which the Industrial Revolution brought into significantly closer contact with society at large. In interaction with the growth of economic prosperity, higher education expanded. At the universities a new ideology gained ground that raised research, alongside teaching, to a principal role. University professors became professional researchers, and the systematic education of young researchers began. As a result of all these developments, the number of scientists multiplied, and national scientific societies were founded in rapidly increasing numbers [4].

It is not surprising that following the expansion of science, international cooperation began to assume organized forms. Technical inventions such as

the railroad, the steamship, and telegraphy greatly facilitated this development. At first, joint scientific work was often concerned with well-defined projects where the need for international collaboration was obvious, and cooperative projects were undertaken in fields such as astronomy, geology, geodesy, cartography, and various aspects of biology. Regional and even truly international disciplinary meetings were initiated [5].

Toward the end of the nineteenth century, the long period of peace began to crack. The coalitions between the great powers were taking shape, and their conflicts of interests, resulting from economic competition and imperialistic ambitions, became more and more accentuated. Nationalism was growing, political and military crises became frequent, armament programs were intensified.

Countering these developments, increasing internationalism assumed a number of forms that aimed at strengthening understanding between peoples. The first Olympic games of the modern era were held in 1896, and the truly international Nobel Prizes were established. The world's scientific community intensified its efforts to work in concert across national borders. Scientists' feelings about the unfavorable political environment echoed the last utterance of Archimedes: *Noli turbare circulos meos.*

Yet political tension grew in the world. A vicious circle had arisen, and finally the explosion came in 1914: the outbreak of the Great War.

1.1 Ideas of International Mathematical Cooperation Awaken

Mathematics did not remain aloof from the strong expansion of scientific research in the nineteenth century. The number of mathematical articles and books appearing each year increased at a rapid pace (by the end of the century, this number had risen to 2,700) [6]. The possibility for an easy overview of mathematical production was gone, and the need for bibliographical expedients arose. Mathematicians realized the advantage, almost the necessity, of providing such resources internationally. The journal *Jahrbuch über die Fortschritte der Mathematik* was founded for the purpose of reviewing the papers appearing in all mathematical research journals in the world. The first volume, covering the year 1868, appeared in 1871. In the preface, the objectives of the *Jahrbuch* were declared as providing surveys of the progress in the broad area of mathematics and facilitating the work of the learned scholar by presenting what was already known [7]. An important step had been taken: The *Jahrbuch* (later succeeded by other review journals) became indispensable for mathematical research.

The *Jahrbuch* was founded in Germany. Its editors were German, and so were the reviewers for the first volume. However, an appeal to international cooperation was made, and from the second volume on, German

reviewers were joined by mathematicians from other countries, first from Austria, Britain, Denmark, Italy, and Russia. With the years, the number of non-German coworkers rose steadily. A notable exception were the French, who did not participate as reviewers, although their papers were reviewed. In 1885 the French inaugurated the *Répertoire bibliographique des sciences mathématiques*, which provided a systematic catalogue of all mathematical publications, which were divided into several topical classes and subsections. Coworkers were soon recruited from outside France [8]. The aftermath of the Franco-Prussian war (1870–1871) still hampered collaboration between German and French mathematicians. But a German bibliographical project initiated in 1894, the *Encyklopädie der mathematischen Wissenschaften*, led to joint international work in which emphasis was placed on German–French cooperation [9].

In the last decades of the nineteenth century, the growth of mathematical research continued at an accelerated pace. At the same time, existing national mathematical societies were activated and new ones established in many countries.[1] The strengthened relationship between mathematicians at the national level was probably conducive to joint work in an international setting. The universality of mathematics was also a contributing factor [10].

The need for organized international mathematical cooperation beyond the bibliographical was felt early by Georg Cantor (Fig. 1.1), who was professor at the University of Halle, Germany. He not only propagated with force the idea of forming a mathematical society in Germany, but he proposed in 1888 that German and French mathematicians should meet at a neutral site, perhaps in Belgium, Switzerland, or the Netherlands. Two years later, when he became the first president of the German Mathematical Society, Cantor had arrived at the idea of an international congress of mathematicians. In a letter of August 1890, Walther von Dyck wrote to Felix Klein, *"G. Cantor schrieb mir in letzter Zeit über sehr hochfliegende Pläne betr. internationaler Mathematikercongresse. Ich weiss wirklich nicht, ob das ein wirkliches Bedürfnis ist."* (G. Cantor wrote me recently of very high-flown plans concerning international congresses of mathematicians. I really do not know whether that is a real need) [11]. In 1894 Cantor noted in his letter to the Russian mathematician A. Vassiliev that he had had the idea for an international congress in mind for five years. Besides Vassiliev, Cantor was in active correspondence about international congress in 1894–1896 with several mathematicians in France—Charles Hermite, Camille Jordan, Henri Poincaré, C.-A. Laisant, and Emile Lemoine—and with the German mathematicians Klein, von Dyck, and others [11, 12].

[1] A mathematical society was founded in Moscow in 1864, the London Mathematical Society in 1865, the Société Mathématique de France in 1872, the Circolo Matematico di Palermo in 1884, the New York Mathematical Society in 1888, becoming in 1894 the American Mathematical Society, and the Deutsche Mathematiker-Vereinigung in 1890.

FIGURE 1.1. Georg Cantor (1845–1918). Founder of set theory. He was an early advocate of regular International Congresses of Mathematicians with well-defined rules, and he advanced the idea of an International Association of Mathematicians.

In addition to the requirement that such congresses provide the rapidly growing mathematical community an international forum for presentation and discussion of their work, Cantor had personal motives behind his activities. He felt a need to turn to international contacts because his revolutionary ideas in set theory had exposed him to the hostility of his German colleagues. At the same time, he stressed his non-German origins. (His father was Danish, and he had been born in St. Petersburg, where he had spent his childhood) [13].

At the close of the nineteenth century, Felix Klein (Fig. 1.2), who had become a professor in Erlangen at the age of twenty-three, was already a legendary figure in mathematical circles. He also had a keen interest in the German Mathematical Society, appreciating Cantor's skill in its formation but expressing policy disagreements with him. The two seem not to have had warm personal relations, and they did not work together in organizational affairs. Cantor spoke ironically of "the great Klein." (The German word *klein* means *small.*)

FIGURE 1.2. Felix Klein (1849–1925). His "Erlanger Program" (the role of the group concept in geometry) of 1872 influenced mathematical development. In 1893 in Chicago he proposed that mathematicians form international unions. He was the first President of the International Commission on the Teaching of Mathematics, serving from 1908 to 1920.

Like Cantor, Klein became convinced of the importance of international cooperation in mathematics. A good record of his views exists thanks to a congress of mathematics and astronomy that was held in Chicago, in connection with the Columbian Exposition, in August 1893. At that time, Chicago was still far from the centers of mathematics, all of which were in Europe. With forty-five participants, the Chicago congress was rather small, and not very international, since only four mathematicians, all Europeans, were from outside the United States. Yet a mathematical conference as early as 1893 with participants from two continents was a historical event. Moreover, among the Europeans was Klein, who undertook the journey as an imperial commissioner of Kaiser Wilhelm. Klein had contacts at the University of Chicago, where two of its three mathematics professors, Oskar Bolza and Heinrich Maschke (the third was E. Hastings Moore), were his former students. Klein, who had brought with him several mathematical

papers of his colleagues, contributed decisively to the value of the Chicago meeting.

In his opening address, "The present state of mathematics," Klein concluded with what might be condensed into the slogan, "Mathematicians of the world, unite!" Now, a hundred years later, Klein's ideas are still relevant to international mathematical cooperation. In the 1950s, when the rapid growth of International Congresses of Mathematicians caused worry, views very similar to those of Klein were expressed to justify their organization (Section 7.3).

More precisely, Klein pointed out that "famous investigators of the early part of the nineteenth century—Lagrange, Laplace, Gauss—were each great enough to embrace all branches of mathematics and its applications. With the succeeding generation, however, the tendency to specialization manifested itself. Thus the developing science departed more and more from its original scope and purpose and threatened to sacrifice its earlier unity and to split into diverse branches." In conclusion, Klein said, "A distinction between the present and the earlier period lies... in that what was formerly begun by a single mastermind, we now must seek to accomplish by united efforts and cooperation." After referring to the beneficial influence of the French, German, and New York Mathematical Societies, he made the appeal, "But our mathematicians must go further still. They must form international unions, and I trust that this present World's Congress at Chicago will be a step in this direction" [14].

Klein did not explain what he meant by "international unions," and there is no record that he would have pursued the idea of forming such unions. In this direction it was Cantor who made a concrete attempt. In January 1896 he applied for a travel grant to promote in France and Italy the idea of establishing an International Association of Mathematicians. However, his application was turned down by the Prussian Kultusministerium [11]. At the same time as this setback, Poincaré ceased to correspond with Cantor, and Laisant and Lemoine, though eager supporters of the idea of an international congress, did not show interest in Cantor's proposal to form a secret triumvirate to prepare detailed rules for such a congress. A feeling of frustration seized Cantor. After March 1896, he no longer dealt with international mathematical collaboration in his known correspondence [12]. He did not take part in the final implementation of the first international congress, in which the leading role was played in Germany by Klein and Heinrich Weber.

In France, the idea of an international congress of mathematicians also came early under discussion. In the preface of the first volume of the journal *L'Intermédiaire des mathématiciens* in 1894, the editors Laisant and Lemoine expressed ideas very similar to those Klein had presented in Chicago. Referring to ancient times, when scientists kept their methods hidden from one another, Laisant and Lemoine remarked that conditions now had changed. Science had expanded, and scholars were now making

their discoveries immediately known. A collective effort had replaced the individual efforts of their predecessors.

In the same volume, Laisant and Lemoine urged the organization of an international congress of mathematicians. In so doing they pointed out that from many directions, from France and from abroad, the idea of a congress had been submitted to them, "certainly without concerted action." Laisant and Lemoine made proposals of certain general principles that such congresses should obey [15]. These were largely followed at the first International Congress of Mathematicians in 1897.

In 1895 Laisant could write about the international congress that "some of the most brilliant scholars have exhibited real passion for it." He said that nobody could monopolize credit for the idea, though names like Cantor and Lampe in Germany, Vassiliev in Russia, Hermite and Poincaré in France, Neuberg in Belgium, should be cited as adherents, and many others also [16].

1.2 Formation of Institutionalized Congresses in 1897

In the years 1894–1895, the idea was indeed spreading that an international congress of mathematicians should be organized. At the 1894 annual meeting of the German Mathematical Society, which Cantor did not attend, French mathematicians had brought forth this idea. It was met with sympathy by the German society, which commissioned its executive board to keep up with developments. At its meeting a year later, the German society, while endorsing the idea in principle, expressly refused to take any initiative toward organizing an international conference. In contrast, the French society agreed to promote the constituent meeting [12, 13]. In 1895 the American Mathematical Society also formally endorsed the idea of an international congress.

At an early stage it was agreed that the congresses should form a permanent institution in the sense that they should have rules governing their activities and that they should be arranged regularly, at intervals from three to five years. Cantor had proposed that a constitutive congress be organized in 1897 in a neutral country—Switzerland or Belgium—and that the first international mathematical congress be held in 1900 in Paris. He obtained support from Vassiliev and others.

The site of the first congress remained open for a while. In September 1895, Cantor still spoke about Switzerland or Belgium, but three months later Zurich seemed to have become the favorite, in view of the Swiss tradition of promoting international interests [11]. In 1896, Swiss mathematicians gave their formal agreement to organize the first International Congress of Mathematicians in Zurich, at the Eidgenössisches Polytechnikum,

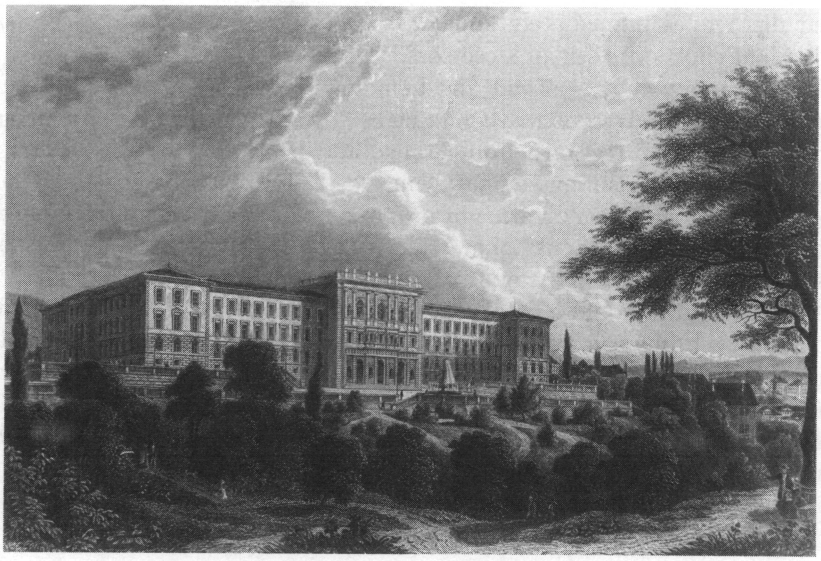

FIGURE 1.3. Main building of the Federal Institute of Technology, Zurich, which has had unparalleled affiliation with the ICMs and IMU. It was the venue of the Congresses of 1897, 1932, and 1994. Of its professors, Hopf, Chandrasekharan, and Moser were Presidents of the IMU and Eckmann the Secretary.

now called the Eidgenössische Technische Hochschule (Federal Institute of Technology), and the date was set for 9–11 August 1897 (Fig. 1.3). The account of the Swiss organizers of the events that led to the Zurich Congress did not go into detail. But it confirmed once more that the time was ripe for international cooperation in mathematics: "After the idea of an International Congress of Mathematicians was awakened several years ago and then eagerly discussed by colleagues from a variety of nations, mathematicians from Zurich were repeatedly asked whether they would not be prepared to undertake a first attempt and arrange an international gathering of mathematicians" [17].

The Swiss soon internationalized the Organizing Committee through the co-option of foreign members. This happened at the suggestion of the German Mathematical Society, which, while having been reluctant to take any formal initiative towards the organization of the Congress, now in all ways gave it moral support. The Germans also proposed that Klein and Poincaré be made members of the enlarged Committee [18]. Thus, the letter of invitation was signed by the president of the Swiss organizing committee, C.F. Geiser, and a few other Swiss mathematicians, as well as by L. Cremona (Italy), A. Greenhill (Great Britain), G.W. Hill (USA), F. Klein (Germany), A. Markov (Russia), F. Mertens (Austria), G. Mittag-Leffler (Sweden), and H. Poincaré (France).

By modern standards, the mathematical community was still small at the time of the Zurich Congress. Nonetheless, 208 mathematicians from sixteen countries took part in the Congress. Central European representation predominated. The largest contingents of ordinary members were sixty from Switzerland, forty-one from Germany, twenty-three from France, twenty from Italy, and seventeen from Austria-Hungary. There were also twelve from Russia, not counting the four from the Grand Duchy of Finland, who were listed separately, and seven from the United States of America. Only three mathematicians came from Great Britain; a kind of isolationism has been offered as a reason for the low British turnout [6]. A simultaneously occurring conference in Canada was said to have further reduced British attendance.

A list of participants was compiled, with listings separately by gender: 204 men and 38 women. Closer scrutiny reveals that of the women, only four were mathematicians. The presence of women was overlooked in the official bilingual announcements, which were addressed to *Hochverehrter Herr* or *Monsieur et très honoré confrère*. German and French were the official languages. Lectures could also be given in Italian or English, but none were held by British or American members. Of the thirty-four lectures printed in the Proceedings, seventeen were in French, fourteen in German, and three in Italian.

In 1897 the empires of Britain, France, Germany, Italy, and Russia covered a good part of the globe. But their mathematicians came from Europe; the only mathematicians from outside Europe were the seven participants from the United States. In connection with mathematics, at the end of the nineteenth century the word "international" had a limited connotation.

The Congress was truly mathematical, not merely a constitutive meeting. The mathematical program was divided into plenary lectures of a general character and specialized lectures in prescribed sections. The plenary speakers were invited by the Organizing Committee. The structure of the mathematical program of this first ICM has preserved many of its essential features to this day.

The great achievement of the 1897 Congress was that as planned, the ICMs became a permanent institution. First, it was decided to continue to hold ICMs every three to five years. The site of each Congress would be chosen at the end of the previous one. In Zurich it was formally decided to hold the next Congress in Paris, in 1900. Second, the Zurich Congress adopted well-defined rules. These applied to the 1897 Congress and were intended to guide future Congresses as well.

It was resolved in Zurich that the purpose of the Congress was (a) to promote personal relations among mathematicians of different countries, (b) to give surveys of the present state of the various parts of mathematics and its applications and to provide an occasion to treat questions of particular importance, (c) to advise the organizers of future Congresses, and (d)

to deal with questions related to bibliography, terminology, etc. requiring international cooperation.

An important decision of the Congress was that permanent Commissions could be formed to implement these aims. The proposal was made to appoint three such Commissions, one to give surveys, if possible, of the developments of the various parts of mathematics, one to report on mathematical bibliography and on attempts that could be made to achieve a more rational, simple, and uniform terminology. The third was to advise how to give the ICMs a more permanent character, for example, through archives, libraries, publications, and a secretariat. An embryo of the mathematical union can be seen here. To do all this would have been an ambitious task, and ultimately only one Commission was set up to study those of the proposed subjects it regarded as important. This Commission was to report to the Paris Congress in 1900.

Each Congress member had the right to vote. The first plenary session elected an Executive Committee, which was in charge of the Congress. Specifications were approved about administrative technicalities of the meeting and various other items. Most importantly, guidelines were given about the publication of the Proceedings of the Congress.

Already at the Zurich Congress, as later at subsequent ICMs, social events constituted an important part of the program. Considerable effort had been expended on its organization. The words of Adolf Hurwitz, the head of the Swiss reception committee, have been quoted to characterize the spirit aspired to at the ICMs: "The great ideas of our science are often born and matured in solitude; no other branch of science, with the possible exception of philosophy, possesses such a secluded character as mathematics. And yet a mathematician feels the need to communicate, to participate in discussions with colleagues.... May the inspiring force of personal communication show its existence in these days, which provide so many occasions for scientific discussions. May the relaxed, cheerful sociability give us delight, enhanced by the feeling that here the representatives of a multitude of nations are unified by the most ideal interests, in peace and in friendship."

Contemporary reaction to the Zurich Congress was positive. On inviting the members to the next International Congress, Emile Picard said that the success of the first meeting guaranteed the future of the institution that had just been founded [17]. The hundred years since the Zurich congress, during which twenty-two ICMs have been held, have fully confirmed the validity of Picard's vision.

With time, the importance of the Congresses has become self-evident. Not only did the old Union in 1920 and the new IMU in the 1950s establish a connection with the ICMs, but a retrospective look actually allows a stronger statement: In the history of the IMU the year 1897 stands out, when the institution of the ICMs was formed, as does 1958, when the movement began to transfer to the IMU responsibility for the scientific

FIGURE 1.4. Henri Poincaré (1854–1912). Mathematician and philosopher of science, with Hilbert the outstanding mathematician in the early 1900s. He was an eminent figure in France in the promotion of international mathematical cooperation. Poincaré served as President of the Paris Congress in 1900.

program of the Congresses. A description of the relations between the IMU and the ICMs will occupy a good portion of the rest of the book.

1.3 International Mathematical Activities Before World War I

The second ICM was held in Paris during 6–12 August 1900, under the presidency of Henri Poincaré (Fig. 1.4). Charles Hermite was elected Honorary President. The Congress was one of about two hundred scientific conferences held in Paris in that year in connection with the World Exhibition. Unlike most of the other conferences, the ICM already had a permanent character. Attendance, 253 mathematicians, was twenty percent higher than it had been in Zurich three years earlier.

Dissatisfaction was expressed about the limited social program, which did not give enough possibilities for the members to meet informally. To

FIGURE 1.5. David Hilbert (1862–1943). One of the great mathematicians of the twentieth century. Hilbert presented his historical problems at the ICM-1900 and led the return of German mathematicians into the ICM in 1928.

the further dissatisfaction of the participants, the Commission that had been set up in Zurich to discuss questions it regarded as important had almost nothing to report to the Congress.

In spite of these complaints, the Paris Congress will forever bask in a special glory. It will be remembered in the history of mathematics for David Hilbert's address, in which he made predictions about the development of mathematics in the twentieth century and presented his famous problems. Hilbert (Fig. 1.5), professor in Göttingen, was thirty-eight at the time of the Congress and already regarded, together with Poincaré, as the greatest living mathematician. In concluding his lecture, Hilbert came close to the views expressed by Klein in 1893 when he said, "The question is forced upon us whether mathematics is once to face what other sciences have long ago experienced, namely to fall apart into subdivisions whose representatives are hardly able to understand each other and whose connections for this reason will become ever looser. I neither believe nor wish this to happen; the science of mathematics as I see it is an indivisible whole, an organism whose ability to survive rests on the connection between its parts" [19]. Ninety years later, these words of Hilbert were quoted to justify the organization of the mammoth ICM-1990 in Kyoto (Section 12.4).

Since 1900, the ICMs have always taken place every fourth year, except for the interruptions caused by the First and the Second World Wars and the postponement of the 1982 Congress by one year. In 1904, the Congress was held in Heidelberg, with 336 participants. In the first two ICMs, the organizing committee had included foreign members, but now it was purely German. The Congress emphasized the international character of the meeting by inviting four plenary lectures, one each to be given in English, French, German, and Italian. A special feature was an extensive exhibition of mathematical literature, apparatus, and models. The social program was organized in great style [20].

The Rome Congress in 1908 was larger than the previous ones but still overwhelmingly European. Of the 535 participants, only nineteen were from four non-European countries, and of these, sixteen were from the United States [21]. Two remarkable initiatives were proposed and accepted. First, A. Conti, from Bologna, suggested that before the next Congress it be considered whether an international association of mathematicians should be established. Thus, the ideas of Klein and Cantor were reintroduced, this time as a formal proposal to the Congress.

The second initiative concerned the teaching of mathematics. There were reasons for establishing international cooperation. The educational systems of the major countries of Western Europe and North America had expanded at the beginning of the century, and in many countries innovators had attempted to carry out significant reforms of the school mathematical curriculum. The Rome Congress accepted the following resolution: "The Congress, recognizing the importance of a comparative study on the methods and plans of teaching mathematics at secondary schools, charges Professors F. Klein, G. Greenhill, and Henri Fehr to constitute an International Commission to study these questions and to present a report to the next Congress" [21]. The resolution was submitted on the initiative of David Eugene Smith, from New York. The proposal had in fact been formulated already in 1905 in Smith's response to an article by Henri Fehr [22].

The three-man group designated by the Congress took the name "Central Committee," with Klein as President, Greenhill as Vice President, and Fehr as Secretary General. The Committee sent an invitation to all countries with an established secondary education to join the Commission. This initiative met with considerable success, perhaps due to the nonideological character of mathematics. Attempts to achieve international cooperation in other fields of education failed at this politically tense time. The program as formulated in Rome was thought to be too restrictive, and thus the teaching of mathematics was considered at all types of schools, including primary and vocational, and also at universities. As early as September 1908, the Committee arranged a preliminary meeting in Cologne to outline the work of the Commission. A partly international conference of the Commission was held in Brussels in August 1910. The plenary conference in Milan in

September 1911 was a veritable international congress on mathematical education [22].

The 1912 International Congress of Mathematicians was held in Cambridge, England. The number of non-European participants had risen considerably, to eighty-two of a total of 574: Asia, six; Africa, two; North America, sixty-seven; South America, seven. Ten countries outside Europe were represented. Among them, the United States dominated, with sixty participants.

The idea to form an international mathematical organization did not progress. The President of the Congress, Sir George Darwin, commented on the proposition at the final meeting of the Congress as follows: "It was proposed at Rome that a constitution should be formed for an International Association of Mathematicians. I have not heard that any proposal will be made tonight, and I do not hesitate to express my own opinion that our existing arrangements for periodical Congresses meet the requirements of the case better than would a permanent organization of the kind suggested" [23].

If the time was not yet ripe for Conti's proposal, the Commission on the Teaching of Mathematics (*Commission Internationale de l'Enseignement Mathématique*) could report on a good start: "Several countries, in one way or other, have recognized officially the work, and have contributed financial support. About 150 reports have been published, and about 50 will appear later." Yet the four-year period 1908–1912 had proved too short for presenting a comprehensive survey of the different national reports. The mandate of the Commission was extended by four more years, to the 1916 Congress. The Commission thus obtained a more permanent character. D.E. Smith was appointed as a fourth member to the Central Committee, in addition to Klein, Greenhill, and Fehr [22].

The Commission held a congress in Paris in April 1914, with 160 participants from seventeen countries. In 1915 Europe was at war, and the scheduled meeting in Munich for that year could not be held. But many national committees continued their work even during the war years. In retrospect, the Commission did a gigantic amount of work in six years, "amassing an amount of information beyond belief" [310]. By 1920, the Commission had produced 187 volumes, containing 310 reports from eighteen countries.

Following the invitation by Gösta Mittag-Leffler, the Cambridge Congress decided to hold the 1916 ICM in Stockholm. But the war made this impossible. It so happened that the very day the hostilities ended on the western front, on 11 November 1918, Mittag-Leffler again took up the question of the Stockholm Congress [24]. He felt that the time for its organization was opportune, once peace prevailed and the menace of Bolshevism hovering over all countries was eliminated. However, it was no longer in the power of Mittag-Leffler to decide about the next Congress. After the war, which had destroyed true internationalism, new winds were blowing.

1.4 Politics Enters into International Cooperation in Science

Going back to the last century, the event from which a continuous path to the birth of the IMU can be traced was the founding of the International Association of Academies in 1899. The so-called Kartell,[2] consisting originally of three German academies and the Austrian academy, had invited the Royal Society (London) to their joint 1897 meeting. While answering in the affirmative, the Royal Society proposed the affiliation of academies from other countries. In consequence, the constitutive meeting of the International Association of Academies (IAA) was held in October 1899 in Wiesbaden, Germany [25]. The meeting was attended by representatives of learned societies and academies from Berlin, Göttingen, Leipzig, Munich, London, Paris, St. Petersburg, Rome, Vienna, and Washington. The Association covered both sciences and humanities. Its object was to initiate and otherwise to promote scientific undertakings of general interest and to facilitate scientific intercourse among different countries. The German academies stressed, then and later, the importance of interdisciplinary cooperation between the sciences and humanities. The activities of the IAA were hampered by the lack of a permanent secretariat to bridge the gaps between meetings, and by the philosophy of considering the holding of funds to be beneath the Association's dignity [5].

Membership in the IAA increased rapidly, and regular meetings were held every three years. The IAA convened for the last time in 1913, in St. Petersburg. In the following year, the outbreak of the war put an end to its activities, although the Association was never formally dissolved. During its lifetime, the IAA had no contact with mathematics, except for the proposal by its humanities section to publish the works of Leibniz. But indirectly, it paved the way for the foundation of the IMU.

The First World War ended in November 1918 with the victory of the Allied Powers, led by France, the United Kingdom of Great Britain and Ireland, and the United States of America. Imperial Russia, an Allied country, had collapsed in March 1917 and was subjected to the regime of the Bolsheviks the same year. The defeated Central Powers were Germany, Austria-Hungary, Bulgaria, and Turkey. The map of Europe changed. Finland, Estonia, Latvia, Lithuania, and Poland, which had been under Russian dominion, became independent states. Upon the disintegration of the Austro-Hungarian empire, Austria and Hungary became totally separated. Czechoslovakia emerged as a new state, and parts of the empire were incorporated into the new Kingdom of Serbs, Croats, and Slovenes, later called Yugoslavia, which also comprised the former Serbia and Montenegro.

[2]The official name was Der Verband wissenschaftlicher Körperschaften.

During the war, an increasing public demand had arisen that there should be found some method to prevent the renewal of the suffering and destruction of modern war. Agreement was reached soon after the opening of the Versailles peace conference on the text of a covenant of the League of Nations, which was adopted in April 1919. The League was to be an organization for the promotion of collective security in the broad sense, including arbitration between states, economic and social cooperation, reduction of armaments, and open diplomacy. Original members of the League consisted of the signatories of the peace treaties and of states that had been neutral in the war. When the League of Nations came formally into being in January 1920, the United States, the most active initiator for its formation, resolved to return to a policy of isolationism and never joined the League.

The political atmosphere was reflected in plans to reorganize international scientific cooperation. As early as November 1916, two years before the end of the war, the Permanent Secretary of the French Academy of Sciences, Gaston Darboux, a mathematician, had written to the Secretary of the Royal Society, Sir Arthur Schuster, suggesting a meeting in Paris between representatives of all Allied nations to confer on scientific questions relating to the war and to international relations after the war. Soon afterwards, Darboux fell ill and died. He was succeeded as Permanent Secretary of the Academy of Sciences by Emile Picard (Fig. 1.6), also a mathematician, who was to become one of the chief architects of postwar international science policy. Picard contacted the Royal Society, formulating the predominant question of the time on the Allied side: *"Veut on, oui ou non, reprendre des relations personelles avec nos ennemis?"* A strongly expressed negative answer appeared in Picard's letter. As a concrete step in this direction, the French academies dismissed most of their German members. Discussions in German academies resulted in the decision not to reciprocate.

The Royal Society was in favor of postponing the inter-Allied conference until the presence of the Americans could be assured. It turned out that there was a divergence of opinion in the United States, where the desirability of taking action before a peace settlement had been accomplished was questioned. However, the French and British views to proceed without delay prevailed [26].

An Inter-Allied Conference on International Scientific Organizations was held in London, at the Royal Society, on 9–11 October 1918 [27]. Eight countries—Belgium, Brazil, France, Italy, Japan, Serbia, the United Kingdom, and the United States—were represented. Besides Picard and the physicist Schuster, the third important figure at the meeting was the astronomer George Ellery Hale, Foreign Secretary of the United States National Academy of Sciences.

A unanimously adopted declaration, whose draft text was written by Schuster and which served as introduction to the resolutions, explained the underlying reasons for the new science policy:

FIGURE 1.6. Emile Picard (1856–1941). French mathematician, whose theories advanced researches into complex analysis and algebraic geometry. He was President of the International Research Council 1919–1931 and Honorary President of the IMU 1920–1932. Picard was a chief architect of the science policy that barred Germany and other Central Powers from the IRC and its Unions.

> When more than four years ago the outbreak of war divided Europe into hostile camps, men of science were still able to hope that the conclusion of peace would join at once the broken threads, and that the present enemies might then once more be able to meet in friendly conference, uniting their efforts to advance the interests of science; for ever since the revival of learning in the Middle Ages, the prosecution of knowledge has formed a bond strong enough to resist the strain of national antagonism. And this bond was strengthened during the latter part of last century, when branches of science developed requiring for their study the cooperation of all the civilized nations of the world. International associations and conferences rapidly multiplied, and the friendly intercourse between the learned representatives of different countries grew more intimate, in spite

> of their political differences, which were admitted, but not insisted upon.
>
> In former times war frequently interrupted the co-operation of individuals, without destroying the mutual esteem based on the recognition of intellectual achievements; peace then soon effaced the scars of the strife that was ended. If to-day the representatives of the Scientific Academies of the Allied Nations are forced to declare that they will not be able to resume personal relations in scientific matters with their enemies until the Central Powers can be readmitted into the concert of civilized nations, they do so with a full sense of responsibility, and they feel bound to record the reasons which have led them to this decision.

The Central Powers were said to have broken the ordinances of civilization, disregarding all conventions and unbridling the worst passions that the ferocity of war engenders. In order to restore the confidence without which no scientific intercourse could be fruitful, the Central Powers would have to renounce the political methods that had led to the atrocities that had shocked the civilized world.

The new policy was made explicit by means of ten resolutions. The first of them read, "That it is desirable that the nations at war with the Central Powers should withdraw from the existing Conventions relating to International Scientific Associations in accordance with the Statutes or Regulations of such Conventions respectively, as soon as circumstances permit; and That new associations, deemed to be useful to the progress of science and its applications, be established without delay by the nations at war with the Central Powers, with the eventual cooperation of neutral nations."[3]

The academies represented in London were invited to initiate the formation of a national council for the promotion of various branches of scientific and industrial research, including those relating to national defense. An International Council should be formed by the federation of the national councils. This Council was not meant to cover the humanities, for which a separate international organization was being planned at the same time. Thus, the International Association of Academies was to be replaced by two new organizations.

The London meeting was followed by a conference in Paris, in November 1918. There, the planned International Council took shape. Detailed draft statutes of the Council were discussed. Under the auspices of the Council, international associations or unions could be formed [28]. A pro-

[3]This principle was included in the Versailles Peace Treaty, which was signed in June 1919 and brought into force in January 1920. Its Clause 282 declared all scientific conventions with Germany invalid, except for the meter convention and the International Institute of Agriculture in Rome.

visional executive committee was appointed to undertake the preparations for the constitutive assembly of the Council. It was decided that the neutral countries Denmark, Spain, Monaco, Norway, the Netherlands, Sweden, Switzerland, and the new states Czechoslovakia and Finland be invited to the Council. Poland, which had just declared independence, was not yet mentioned. Russia, where civil war had started, was left outside these discussions.

The Constitutive Assembly of the International Research Council, IRC, *Conseil international de recherches*, was held in Brussels during 18–28 July 1919.[4] It was a large meeting, where the ideological basis and practical implementation of the postwar international science policy were ratified. During the eleven days of the meeting, a great number of plenary sessions were held, as well as special meetings for the formation of various scientific unions. The conference was attended by 225 delegates from twelve countries. The distribution was uneven: The 106 from Belgium and 48 from France constituted a clear majority. The United States had twenty-seven delegates, the British nineteen, and the Italians fifteen. The other participating countries—Canada, Japan, New Zealand, Poland, Portugal, Romania, and Serbia—all together accounted for the remaining ten delegates [30].

The dominant language of the Brussels meeting was French. The view was expressed that half at most of what was said at the various sessions had been understood by many of the members present [31]. Even later, French remained the principal language of the Council. However, English was also widely used; the two General Secretaries of the IRC (Sir Arthur Schuster and Sir Henry Lyons), elected in 1919 and 1928 respectively, were both British.

The choice of Brussels for the inaugural meeting and the presence of the King of Belgium at the opening session (three weeks after the signing of the Versailles treaty) underlined the postwar nationalistic feelings that characterized the IRC then and for some years thereafter. Yet the Belgian chairman said at the opening that the Belgians did not intend to keep up a permanent state of intellectual war, of unlimited duration.

The draft statutes of the Council were considered, and a final text was approved [32]. The objectives of the IRC were stated:

1. To coordinate international efforts in the different branches of science and its applications.

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[4] In the same year the counterpart of the IRC for humanities, *Union Académique Internationale* (International Academic Union, or International Union of Academies), was established in Paris. It has kept its French name through the years. In 1995 it was felt that "it will save much confusion if the abbreviation UAI is always retained." The UAI was closer to the IAA than was the IRC. Its members are academies and it does not have disciplinary unions. It works through collective projects [29].

2. To initiate the formation of international associations or unions that are deemed to be useful to the progress of science.

3. To direct international scientific activity in subjects that do not fall within the purview of any existing international associations.

4. To enter through the proper channels into relations with the Governments of the countries adhering to the IRC in order to promote investigations falling within the competence of the Council.

In comparison with its predecessor, the IAA, the IRC was more directly related to the conduct of science. A marked change was the abandonment of the "German model," that of having both sciences and letters represented in the same organization.

An essential characteristic of the new Council resulted from its membership provisions. The IRC and its Unions were not open to all countries. The initial membership was restricted to the Allied Powers; the Central Powers were excluded. According to the statutes, the following countries were allowed to participate in the foundation of the IRC and of any scientific Union connected with it or subsequently to join such a Union: Belgium, Brazil, the United States, France, the United Kingdom, Australia, Canada, New Zealand, South Africa, Greece, Italy, Japan, Poland, Portugal, Romania, and Serbia. As for other nations, the statute read, "After a Union has been formed, nations not included in this list, but fulfilling the conditions of Article 1 of the resolutions of the Conference of London (cited above in this section), may be admitted either at their own request or on the proposal of one of the countries already belonging to the Union." The Council was to remain firmly in the hands of the Allies, but even the ultras allowed the membership of neutral countries to prevent them from joining a possible German-dominated competitor to the IRC. Administratively, a country could join the IRC or any Union connected with it either through its principal Academy, its National Research Council, some other national institution or association of institutions, or through its government.

The General Assembly, consisting of the delegates of the member countries, was to meet every third year. The Unions were explicitly subject to the parent organization IRC: The statutes of the unions required the approval of the General Assembly of the Council. Furthermore, the statutes of each Union were to contain the provision that the admission of countries to the Union should be subject to the regulations of the IRC. By an oversight, however, there was no explicit rule to the effect that a country must be a member of the IRC before it could be admitted to membership of the Unions. This was corrected later: "That only countries which have adhered to the IRC are entitled to be members of the Unions connected with it."

Four scientific Unions were established under the IRC, those of astronomy, geodesy and geophysics, pure and applied chemistry, and scientific radio-telegraphy. In addition, the Brussels General Assembly prepared stat-

utes of Unions for mathematics, physical sciences, geology, biological sciences, and geography. The preparatory meeting aiming at the establishment of the IMU will be discussed in Section 2.1.

As expected, Picard, Schuster, and Hale were elected to the five-member Executive Committee. Picard became President of the IRC, Schuster the Secretary General, and Hale the Ordinary Member of the Executive Committee. Of the two Vice Presidents, Vito Volterra, from Italy, was a mathematician. The legal domicile of the Council was Brussels. All meetings of the IRC General Assemblies were to be held in Brussels, and so they were, from the first in 1919 to the last in 1931.

The convention establishing the IRC came into force on 1 January 1920, since "at least three of the admissible countries had confirmed their adherence." The convention was to remain in force until 31 December 1931. Then, with the assent of the member countries, it was to be continued for a further period of twelve years.

The German view regarding the new international organizations was clear and definite: Learned societies in France and Britain, supported by their governments, had founded the International Research Council and the International Academic Union for the purpose of undermining the position of German science. In this way, the influence of German science on international cultural life could be eliminated [33]. The very strict German attitude alienated many neutral countries. While disapproving of the ostracism manifested by the IRC, they rejected the alternative of a coalition with Germany and ended by joining the Council [34].

Through the Versailles treaty, postwar arrangements in science were connected with political decisions (see the footnote on page 18), with which they exhibited much similarity. The Research Council could be seen as the counterpart of the League of Nations. Both organizations were created in 1919 on the initiative of the Allied nations, and neutral states soon joined them. In 1926, when the political atmosphere had changed, Germany joined the League and was invited to join the IRC (see Section 2.3). The International Association of Academies, the predecessor of the International Research Council, and the Hague Peace Conferences, the predecessor of the League of Nations, had both convened for the first time in 1899. As a leading representative of the vindictive spirit, Picard was the counterpart of Georges Clemenceau, the French premier in the years 1917–1920.

2

The Old IMU (1920–1932)

The first steps towards the formation of the IMU were taken in Brussels in 1919 at the Constitutive Assembly of the International Research Council. In accordance with the program approved in Brussels, the IMU was founded during the International Congress of Mathematicians in Strasbourg in 1920. Seeds of trouble were sown there. The statutes of the IMU barred the defeated Central Powers from membership. As the passions aroused by the world war were cooling down, opposition grew year by year against this policy. Finally, it became untenable.

In 1926 the International Research Council decided to invite Germany, Austria, Hungary, and Bulgaria to become members of the Council and its Unions. However, German scientists had not forgotten the boycott to which they had been subjected. Disregarding the recommendations from the German government, they declined to join.

In 1928, attendance at the International Congress of Mathematicians was again free from political restrictions. Formally, the participation of Germans, who were not members of the Council, violated the rules of the IMU. The Congress ignored this provision, with the result that the IMU lost its grip on the Congresses. It became increasingly clear that the IMU had failed in its task to promote international cooperation in mathematics. In 1932 an end was put to its activities.

2.1 The Foundation of the IMU in the Aftermath of World War I

During the 1919 Constitutive Assembly of the International Research Council, a session was held with the purpose of preparing the foundation of the IMU. The Belgian mathematician Charles de la Vallée Poussin presided at the meeting, in which a number of important decisions were taken. First of all, Draft Statutes of the IMU, which followed the general pattern of the IRC, were approved by the participants of the meeting [35]. An Interim Executive Committee of the IMU was elected, with de la Vallée Poussin as President and W.H. Young (U.K.) as Vice-President.[1]

It was decided that an International Congress of Mathematicians should take place in September 1920. The invitation tendered by the French delegate Gabriel Koenigs to hold the Congress in Strasbourg was accepted unanimously.

Since due preparations had not been undertaken and the mathematicians were not sufficiently well represented, the Brussels meeting of the IMU was necessarily of a preparatory nature. The duly accredited delegates of the (Allied) nations were to meet in Strasbourg at the time of the Congress to confirm the statutes and to create the International Mathematical Union.

The French insisted on hosting the Congress, in spite of the previous decision to hold the Congress in Stockholm following the ICM-1912. Mittag-Leffler never recognized the Strasbourg Congress as an international event. *"Ce congrès est une affaire française qui ne peut nullement annuler le congrès international à Stockholm."* He compared the Strasbourg Congress to "another local congress," the Scandinavian Congress of Mathematicians [36].

The Secretaries of the Interim Committee were charged with circulating a draft of the statutes of the provisional Union. According to the *Semicentennial History of the American Mathematical Society* (AMS), they failed in their duty [37]. According to the same source, the decision to hold the International Congress in Strasbourg in 1920 was made without consulting the United States and Great Britain.[2] Thus resentment against the IMU arose in the American Mathematical Society even before the Union had been officially founded. More opposition within the AMS was to gather during the 1920s, until the final attack against the Union was launched in 1932. These events will be related in the subsequent sections of this chapter.

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[1] Complete lists of all Executive Committees of the IMU are provided in the Appendix, Section 3.

[2] No mathematicians from the United States were members of the Brussels Assembly, but H. Lamb and W.H. Young were in the British delegation. They were elected to the Interim Executive Committee of the IMU in Brussels and were to serve in the IMU Executive Committee, Lamb as Honorary President and Young as Vice-President and President, through all the years from 1920 to 1932.

During the 1920 International Congress of Mathematicians, the delegates of France, the United Kingdom, Italy, Belgium, the United States, Czechoslovakia, Greece, Portugal, Serbia, Japan, and Poland met in a hall of the University of Strasbourg and confirmed the Statutes of the IMU presented in Brussels the year before [38]. It is not quite clear what authority the national delegates possessed; for instance, membership of the U.K. in the IMU still required the confirmation of the Royal Society, which was given in December 1920. Yet there is good reason to say that the International Mathematical Union was founded in Strasbourg, on 20 September 1920.

The group of founding members was predominantly European—nine of the eleven countries. All were victorious Allies; Czechoslovakia and Poland were also regarded as belonging to this camp. On the day following the foundation of the Union, the other countries whose mathematicians the French had allowed to participate in the Congress were invited to form National Committees for Mathematics and to join the Union.

The Statutes adopted in Strasbourg were in French, and only the French text was to serve for the interpretation of its articles. If an acronym was used for the Union, it was to be UMI (*Union Mathématique Internationale*) rather than IMU, which became dominant only after World War II in connection with the new Union. To the Draft Statutes approved in Brussels the Strasbourg General Assembly made only minor modifications [39]. These first Statutes of the IMU were not very dissimilar to those now in force.

The first section was entitled "Objects of the Union and conditions of admission." The purpose of the Union was to initiate and promote international cooperation in mathematics and to provide for "(1) The encouragement of the pure science. (2) The correlation of pure mathematics with other branches of science. (3) The direction and progress of teaching. (4) Coordination in the preparation and publication of abstracts of papers, tables, graphs, and the construction of appliances, models, etc. (5) The organization of International Conferences or Congresses."

After this list of objectives, the Statutes exhibited the only visible connection between the IMU and the International Research Council: "The admission of countries to the Union shall be subject to the Regulations of the IRC."

The second section dealt with National Committees, which should be formed in each of the countries belonging to the Union. It was largely analogous to the corresponding stipulations of the present Statutes of the IMU.

The third section, on the administration of the Union, deviated in many details but not in its basic structure from the present pattern. The work of the Union was to be directed by the General Assembly of the delegates. The Bureau of the Union consisted of the President, five Vice-Presidents, a Secretary General, and a Treasurer. They were elected by the General Assembly and should hold office until the end of the second General Assembly

following that of their election, provided that the first President and three of the Vice-Presidents (as determined by the drawing of lots) should retire at the end of the first General Assembly following that of their election. Retiring members should not be immediately eligible for reelection. As an additional clause to the Draft Statutes adopted in Brussels, it was decided that Honorary Presidents could be elected at the General Assembly. They would hold office permanently and be members of the Bureau. The Bureau was the Executive Committee of the Union. There should also be an Administrative Office. It comprised, besides the Secretary General and the Treasurer, four Secretaries elected by the General Assembly.

In case of any vacancy occurring among its members, the Executive Committee had the power to fill such a vacancy. A person so appointed should hold office until the next General Assembly. This emergency rule was invoked eight years later, when the Union was confronted by an unexpected administrative problem (see Section 2.5).

The fourth section concerned "Commissions," which the Union could appoint to deal with specific subjects. Questions related to teaching were particularly mentioned. Detailed instructions regarding the election of members and the internal structure of the Commissions were given. Again, there was much similarity with the stipulations now in the By-Laws of the IMU.

After a section on General Assemblies, finance and voting power were treated. The contributions due from the member countries and their corresponding voting powers were determined by the same formula that had been adopted by the IRC. The scale was based on the population as shown in the table below.

Population	Number of votes	Units of contribution
Fewer than 5 million	1	1
Between 5 and 10 million	2	2
Between 10 and 15 million	3	3
Between 15 and 20 million	4	5
More than 20 million	5	8

The inhabitants of the colonies and protectorates of a country could be included in the population if the country so wished. The dominions (South Africa, Australia, Canada, New Zealand) would be considered as independent countries. The annual unit contribution should not exceed 125 francs during the first period of the Convention. In each country, the Adhering Organization to the Union would be responsible for the payment of its assessed dues. The income was to be devoted primarily to the costs of publication and expenses of the Administrative Bureau.

The Statutes would be valid until 31 December 1931. After that date, they would, with the consent of the adhering countries, be extended for another twelve-year period.

The General Assembly elected the following Executive Committee [38]:

Honorary Presidents: C. Jordan (France), H. Lamb (U.K.), E. Picard (France), V. Volterra (Italy)

President: Ch.-J. de la Vallée Poussin (Belgium)

Vice-Presidents: P. Appell (France), L. Bianchi (Italy), L.E. Dickson (USA), J. Larmor (U.K.), W.H. Young (U.K.)

Secretary General: G. Koenigs (France)

Treasurer: A. Demoulin (Belgium)

Of the twelve positions of the Executive Committee, France thus held four, the United Kingdom three, Belgium and Italy two each, and the United States one. The same five countries that had dominated the constitutive meeting of the IRC in Brussels were to play a leading role in the Union.

President Charles-Jean de la Vallée Poussin (Fig. 2.1) had attended every International Congress since the first one in 1897 and taken part in the planning of postwar science policy from the very beginning, having been a Belgian delegate at the London 1918 meeting. In 1928, the king of Belgium conferred upon him the title of Baron [40].

Secretary General Gabriel Koenigs (Fig. 2.2), Professor at the University of Paris (Sorbonne) and Member of the French Academy of Sciences, had not attended any of the prewar International Congresses. He was elected Secretary General until 1928, but for reasons to be explained in Section 2.5, he kept this position three more years, until his death, in 1931. In light of later events, it is apparent that Koenigs inflicted damage upon the cause of the Union by persisting in maintaining an anti-German policy although times had changed and the passions aroused by the war had largely cooled down; the salient facts will be disclosed in the next four sections. It is curious that *Dossier G. Koenigs* in the archives of the French Academy of Sciences does not contain a single paper associated with the IMU. Nor are the activities of Koenigs in the Union mentioned in the memorial address of the French Academy, in his obituary, or in his biography [41].

Discussion and approval of the Statutes was the principal topic at the meeting of the Strasbourg General Assembly. Moreover, a resolution regarding bibliography was adopted. It was decided to ask the editors of mathematical journals to obtain from authors brief abstracts of their articles. There is no record that the resolution would have led to concrete results. The Union was well aware of the importance of the reviewing of mathematical papers. It made several attempts to become involved in this activity in one way or another, in the 1920s and again in the 1950s and 1960s, but never with success.

FIGURE 2.1. Charles-Jean de la Vallée Poussin (1866–1962). Belgian mathematician of prime number theorem fame, who served as President of the IMU 1920–1924 and as Honorary President 1924–1932. He was a principal planner of the Union in 1919 and 1920, and he later distanced himself from the IMU's discriminatory policy.

By the Statutes, the Union was to provide for the organization of the International Congresses. This was interpreted to mean that the Union was to decide about their date and location. In accordance with previous practice, it was agreed to hold a Congress every fourth year. Two countries, the United States and Belgium, expressed willingness to host a Congress. The Assembly decided to hold the 1924 Congress in New York and the 1928 Congress in Belgium [38]. Neither of these decisions was ultimately enforced. Mittag-Leffler continued to insist that an earlier decision to hold a Congress in Stockholm be honored in the near future. But he himself was not present in Strasbourg, and his policy of rapprochement was not popular in 1920.

During the years preceding World War I, the scientific community had disregarded political tensions and kept nationalism at bay. Now a profound ideological change had taken place. Picard, President of the IRC and who

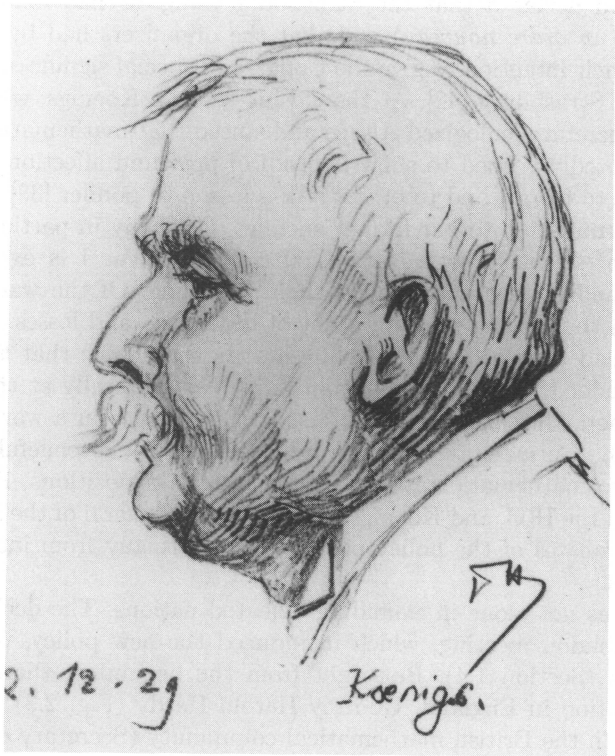


FIGURE 2.2. Gabriel Koenigs (1858–1931). French Secretary General of the IMU 1920–1931. He represented an unrepentant anti-German policy in the Union. Courtesy CNAM-Library-France.

was elected President of the Strasbourg Congress, reiterated in his opening address the main points of the declaration adopted at the 1918 meeting in London (Section 1.4). Having presented an account of the formation of the International Research Council and explained why cooperation with the scientists of the Central Powers was not possible, Picard added, to exclude all possible doubt, *"... pardonner à certains crimes, c'est s'en faire le complice"* (to pardon certain crimes is to become an accomplice in them). His only compromise was the remark that "our successors will see whether a sufficiently long time and a sincere repentance could permit mending the relations that the tragedy of the past years has broken, and whether those now excluded from the accord of civilized nations are worthy of reentering it."

Strasbourg, lying in Alsace-Lorraine, which the French had had to cede to the Germans in 1871 and which was returned to France after World War I, was deliberately chosen as a particularly symbolic site for the gath-

ering. Picard declared that the Strasbourg Congress had inaugurated a new order (*un ordre nouveau*) and that the organizers had by no means concealed their intention to give the Congress a special significance by convening it in Strasbourg [42]. At the closing session, Koenigs, who was the Congress Secretary, eulogized Alsace and stated that mathematical friends had undoubtedly wished to show it proof of profound affection, to others an example to follow, and to others still a lesson to ponder [38].

The determination to bar former enemies, Germany in particular, from international scientific organizations after World War I is explained by an understanding of circumstances then prevailing. Of the war's victors, France held the leading place by right of her efforts and losses. For half a century it had been a common feeling among the French that their country lived under the threat of German arms. Now, literally at the price of their lifeblood, they had finally abolished this menace in a war for which they held the Germans responsible. Hence the strong revengeful feeling in France. Two mathematicians in key administrative positions, Picard, the President of the IRC, and Koenigs, the Secretary General of the IMU, were forceful advocates of the policy of excluding Germany from international cooperation.

France was not alone in excluding defeated nations. The declaration of the 1918 London meeting, which introduced the new policy, was from a British pen (Section 1.4). But right from the beginning, there was also loud opposition in England. Godfrey Harold Hardy (Fig. 2.3), an important figure in the British mathematical community (Secretary of the London Mathematical Society 1917–1926, thereafter twice President and again Secretary), objected strongly to the discrimination against German colleagues. "All scientific relationships should go back precisely to where they were before.... This seems to me worth saying on account of the many imbecilities printed during the last year [1918] by preeminent men of science in England and France." In 1921 he wrote that the object of the IRC was not to promote international cooperation but to exclude the Germans from it [43]. In Hardy's opinion, the British policy offered an example of how a small, determined minority could prevail over an indifferent, disinterested majority.

The United States participated in the meetings preceding the Constitutive Assembly of the IRC and were represented in Brussels by a group of twenty-seven eminent scientists. Apart from an individual protest, there is no record that the American delegation would have disagreed with the political restrictions that were imposed. The influential Hale presented a pragmatic explanation: "I think that if they [the Germans] were to take part in international meetings, the possibility of a return to the old cordial relations would be postponed rather than hastened, because it would be wholly impossible to avoid acrimonious discussions relating to the war" [44].

In the 1940s, when American mathematicians initiated the work that led to the reestablishment of the IMU, the impression spread that the Amer-

FIGURE 2.3. Godfrey Harold Hardy (1877–1947). A leading British mathematician (analysis and number theory) who was a loud opponent of the discrimination policy. Courtesy the London Mathematical Society.

icans had been from the very beginning against the discrimination policy after World War I. This is not true in general, but there were no mathematicians in the American delegation to the Brussels Constitutive Assembly. Consequently, the statutes of the IMU were prepared and the decision made to hold the Congress in Strasbourg in 1920 without consultation with the American mathematicians. And as recounted above, they were not even duly informed about these steps. In any event, in the United States mathematicians soon forgot whatever bitter feelings they might have had. In 1921, in reestablishing foreign membership, the American Mathematical Society explicitly mentioned German mathematicians as eligible [37].

The voices from neutral countries did not carry much weight in those years. An active promotor of reconciliation was Mittag-Leffler (Fig. 2.4), who had lived in Germany and France and had an extensive network of international contacts. In 1882 he had founded *Acta Mathematica*, and he used this journal to bring the mathematicians of Germany and France together in the aftermath of the Franco-Prussian War. Even before the First World War was over, Mittag-Leffler again saw his role as a mediator and began work to reestablish scientific contacts, "which should be exempted from all political folly."

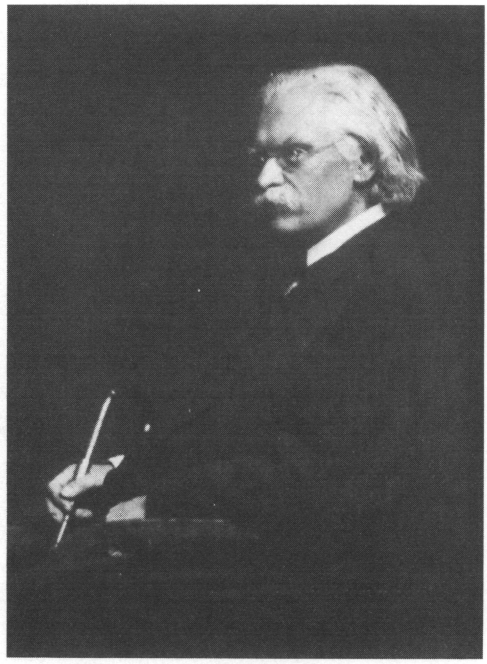


FIGURE 2.4. Magnus Gustaf (Gösta) Mittag-Leffler (1846–1927). A cosmopolitan Swedish mathematician (complex analysis) who worked for rapprochement in mathematics. Honorary President of the IMU 1924–1927.

Mittag-Leffler strongly condemned the policy of discrimination. He was in agreement with Hale's pragmatic opinion that it might be advisable not to invite the Central Powers to the Council and its Unions until the worst passions had cooled. Otherwise, rows and accusations might spoil the meetings. Mittag-Leffler was under the impression that not only England and Italy were conciliatory, but that in France also there was a strong minority, with Appell and Painlevé as leaders, that inclined towards rapprochement. However, Picard was adamantly opposed, and Mittag-Leffler spared no words in criticizing him [45, 46]. Mittag-Leffler was unbelievably active; he even devoted considerable attention to the semantic detail of how to name the Strasbourg conference [47].

The German scientists were of the opinion that even if the statutes had not prevented them from joining the new international organizations, they would in any case have stayed aloof. They felt that the myth that placed the entire guilt for the war on them, the *Kriegsschuldlüge*, poisoned the political climate. This assignment of blame should be dropped completely before normal scientific cooperation would become possible [48].

It is difficult to estimate how much detriment was caused to mathematics by the restrictions on internationalism. It was not limited to the IMU

and the Congresses only, extending, for example, to publishing policy. On the other hand, its effects were attenuated by contacts among individual mathematicians from the different camps.

The Commission on the Teaching of Mathematics had worked to some extent even during the war. Now the new ideology put an end to its activities. In answer to a question from its Central Committee, IMU's Secretary General Koenigs stated that the dissolution of the old Commission was inevitable [22]. No initiative was taken in Strasbourg to form a new Commission. Fehr pointed out that nevertheless, the services of the journal *L'Enseignement Mathématique* were available as before for the promotion of international cooperation.

The work of the Union's Executive Committee—the Bureau, as it was commonly called—is not much commented on in the known correspondence. There were plans to summon the Bureau in 1926 to decide on a site for the 1928 Congress, but the meeting never materialized [49]. There is no known record that the Bureau met between the General Assemblies, which convened every fourth year at the time of the International Congresses. The Bureau did hold a session during the 1928 Congress in Bologna to discuss the critical state of the Union. The tasks of the Union consisted of elections every fourth year; admission of new members; collecting dues; deciding on the site of the International Congresses, which were formally under its auspices; maintaining a feeble contact with the IRC; and proposing some bibliographical projects. There was not much reason for the Bureau to have held extra meetings.

It is striking how few scientific activities the Union undertook. This lack of mathematical substance was a serious flaw. It played a role in the decline of the Union, which became increasingly obvious from 1928 on. In all, the old IMU had poor visibility within the International Research Council and was not well known among mathematicians [50].

2.2 Mounting Opposition Against the IMU's Policy of Exclusion

Attendance at the Strasbourg Congress had been by personal invitation, which were sent by the French organizers to "allies and friends" [42]. With two hundred participants (eighty of them from France), it was the smallest ICM ever. After the establishment of the Union, the exclusion policy was extended to future Congresses, to which participants could be invited only from countries that were members of the IRC. As related above, the Congress in 1924 was to take place in New York. According to the *Semicentennial History of the American Mathematical Society*, L.E. Dickson and L.P. Eisenhart, the American delegates to the Strasbourg General Assembly, had tendered to the assembled delegates an invitation to the 1924

Congress without having consulted the AMS. The Society had reservations about the Congress. In 1922, conditions were felt to have changed so much that financial backing would have been unobtainable in the United States with the restrictions on participation imposed by the IMU. The Americans withdrew their offer to organize the Congress [37]. This was a serious warning to the Union.

In this situation, the Dominion of Canada came to the rescue by offering to arrange the 1924 Congress in Toronto in accordance with the rules of the IMU. This was visibly printed in the Congress Proceedings: "In its organization and the conduct of its proceedings it [the Congress] conformed to the regulations of the International Research Council and the International Mathematical Union" [51].

However, the Canadians were aware of the difficulties. By that time, there were many others besides the AMS protesting against the policy that the IMU had adopted. In May 1924, the British National Union of Scientific Workers issued a vigorous protest against the discrimination policy. The protest (written by Hardy) was given some publicity in the press. From the replies received, Hardy drew the conclusion that "the [National] Union's claim to represent in this matter an overwhelming majority of British men of science was perfectly justified" [52]. It was clear that a Congress held under the regulations of the IMU was bound to alienate many.

The initiative to hold the Congress in Canada was due largely to John Charles Fields (Fig. 2.5), President of the Royal Canadian Institute, who was the Chairman of the Canadian Organizing Committee. There are indications that he did not sympathize with the prohibitory clauses. On the other hand, he realized that the Congress would not have the approval of the Union if it were held as a truly international event [53].

The attendance, 444 ordinary members, did not reach the level of the Congresses held before the war, but it was more than double that of Strasbourg. The geographical distribution differed from that of previous Congresses: 299 from North America, 139 from Europe, 6 from all other continents together. It is of interest to note that among the countries represented were Russia, Ukraine, and Georgia. The Soviet Union was in existence, but it was still a loose federation.

At the opening session of the Congress, the Canadian speakers made no reference to the policy of the Union. Fields opened his speech with the remark that "for the first time an International Mathematical Congress meets in America." He gave a historical survey of the development of mathematical research in America. In less than two generations, America had passed from near sterility in mathematics to a comparatively affluent productivity. Of Canadian mathematics he said that the tree was not yet large, and he expressed the hope that its growth might be stimulated by the Congress.

The opening address of IMU's President de la Vallée Poussin was a mixture of opposing ideologies. In the beginning he found it advisable to stress the official policy prevailing in the Union. In speaking about the 1920

FIGURE 2.5. John Charles Fields (1863–1932). Canadian President of the Toronto International Congress 1924, on whose initiative the Fields Medals were instituted. Fields was Honorary President of the IMU 1924–1932.

Congress in Strasbourg he said, *"Ce n'était seulement un congrès scientifique... c'était un symbole et c'était une fête, celle de la délivrance de l'Alsace et aussi, comme je disais alors, celle de la libération de la science que des mains sacrilèges avaient asservies trop longtemps à des dessins criminels."* (It was not only a scientific conference... it was a symbol and a celebration of the deliverance of Alsace and also, as I then said, of the liberation of science, which sacrilegious hands had too long subjugated to criminal designs.) Having said this, he let it be understood that times had changed. He recalled that the competitors for the 1924 Congress were Belgium and the United States. Even as a Belgian, he felt that it was better not to hold the Congress in a location too closely connected with reminiscences of the war. To make his point clear, he added, *"Après Strasbourg, il fallait affirmer avant tout le caractère international et exclusivement scientifique du congrès."* (After Strasbourg, the international and exclusively scientific character of the Congress had to be affirmed.) In spite of the restricted participation, de la Vallée Poussin quoted words of Hurwitz at the ICM-1897 (see Section 1.2) about the brotherhood of mathematicians of various nations. He ended with the appeal, "Be our meetings frank and cordial and serve as a lesson and example to the world!" [51].

The General Assembly of the IMU was held in Toronto on 15 August 1924. Fourteen member countries were represented: Belgium, Canada, Czechoslovakia, Denmark, France, Great Britain, Italy, the Netherlands, Norway, Poland, Portugal, Sweden, Switzerland, and the United States. By Secretary General Koenigs's official report, *Etaient, en outre présents plusieurs savants des pays suivants qui n'ont pas encore adhéré à l'Union: Espagne, Géorgie, Russie, Inde."* (Also present were several scholars from the following countries that have not yet adhered to the Union: Spain, Georgia, Russia, India.) The participation of countries that were not members of the IRC was against the statutes, but the violation was ignored in Toronto. Four years later, the same Koenigs resorted forcefully to this stipulation when the question was about the attendance of Germany.

A special Commission for Bibliography under the President of the Union was established. This was the only decision of the Assembly connecting the Union with a mathematical activity. The minutes of the meeting of the General Assembly did not specify the tasks of the Commission.

The Assembly elected the following Executive Committee:

Honorary Presidents: L.E. Dickson (USA), J.C. Fields (Canada), H. Lamb (Great Britain), G. Mittag-Leffler (Sweden), E. Picard (France), Ch.-J. de la Vallée Poussin (Belgium), V. Volterra (Italy)

President: S. Pincherle (Italy)

Vice-Presidents: P. Appell (France), G.A. Bliss (USA), H. Fehr (Switzerland), L.E. Phragmén (Sweden), W.H. Young (Great Britain)

Secretary General: G. Koenigs (France)

Treasurer: A. Demoulin (Belgium)

The seventy-one-year-old Salvatore Pincherle, President of the Unione Matematica Italiana, was elected President of the IMU for the eight-year period 1924–1932. De la Vallée Poussin, Dickson, Fields, and Mittag-Leffler were new Honorary Presidents, and Bliss (USA), Fehr (Switzerland), and Phragmén (Sweden) new Vice-Presidents [54].

As before, French, British, American, Belgian, and Italian mathematicians formed the majority in the Bureau, eleven of fifteen members. However, unlike the first period of 1920–1924, they were now joined by others—by a Canadian, two Swedes, and a Swiss.

Many American mathematicians who attended the Congress discovered for the first time when they arrived in Toronto that Germans had been excluded. Much indignation was said to have been expressed. At the meeting of the General Assembly, the American delegates offered a resolution—which was endorsed by Italy, the Netherlands, Sweden, Denmark, Norway, and the U.K.—requesting the IRC to consider whether the time was ripe for the removal of restrictions on membership now imposed by the rules

of the Council [51]. Of the three great Western Allies in the war on whose insistence the exclusion policy had been adopted, the accredited mathematical delegates of the U.K. and the U.S. had thus had enough of political restrictions and were in favor of abolishing them in 1924.[3]

After the Toronto Congress, Hardy expressed prophetic views. In his opinion, it was safe to say that the ICM-1924 was the last "boycott" Congress of mathematicians. If the IRC would not remove the ban on German science, the IMU would collapse or degenerate into a purely Franco-Belgian affair [52].

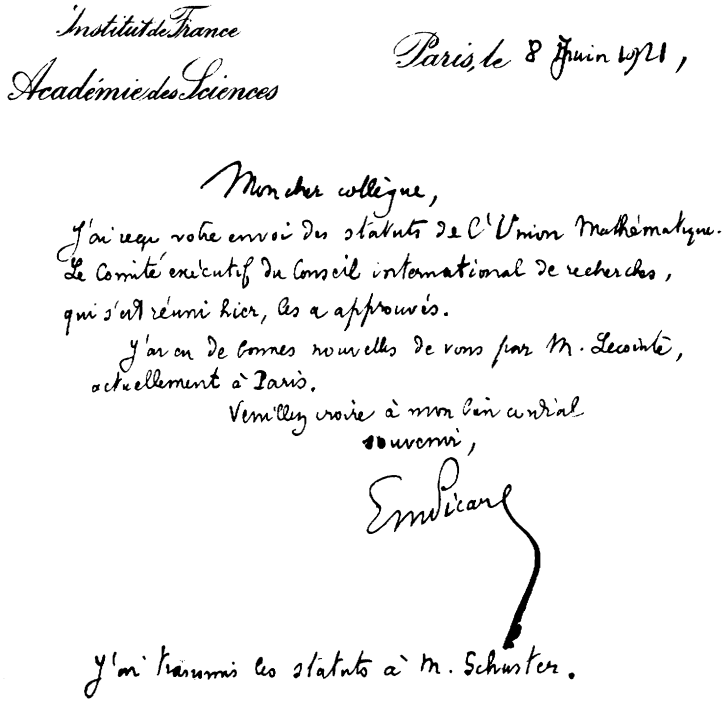
President Pincherle and Secretary General Koenigs, the two leading figures of the Union, did not work well together. A year after the Toronto General Assembly, Pincherle wrote to IRC's Vice-President Volterra how amazed he was at having learned that the IRC had not been informed about his election as President of the IMU. Pincherle continued that it could be due only to the inertness of Secretary General Koenigs: *"che lascia spesso e volentieri le lettera senza risposta e prende con molta... calma le proprie funzioni"* (who frequently and willingly leaves letters unanswered and takes his functions with much calm) [55]. Before long, Pincherle and Koenigs were on a collision course about the policy to be followed at the 1928 International Congress.

2.3 Transformation of the International Research Council into the International Council of Scientific Unions

When the umbrella organization, the International Research Council (IRC), was founded, its membership was restricted to countries. At its second General Assembly, in 1922, the formation of five Unions was recognized. Among them was the IMU, whose statutes had been approved by the Executive Committee of the IRC in June 1921(Fig. 2.6). The statutes of the IRC were amended to provide for an enlarged Executive Committee consisting of five members elected by the General Assembly, together with one delegate of each of the five Unions. On the other hand, the General Assembly consisted of the delegates of the member countries only. It was not until the International Council of Scientific Unions was founded in 1931 to replace the IRC that the Council adopted complete dual membership.

During the 1920s, pressure mounted in the IRC along two lines: First, the Council should be open to all scientists irrespective of nationality, and second, the Unions should have more say in their internal affairs. At the

[3]In protest against the exclusion of Germans, Finnish mathematicians were absent from Toronto. The boycott had been suggested by Ernst Lindelöf (who himself was close to French mathematical research and had made extensive visits to Paris).


Institut de France
Académie des Sciences

Paris le 8 Juin 1921,

Mon cher collègue,

J'ai reçu votre envoi des statuts de l'Union Mathématique. Le Comité exécutif du Conseil international de recherches, qui s'est réuni hier, les a approuvés.

J'ai eu de bonnes nouvelles de vous par M. Lecointe, actuellement à Paris.

Veuillez croire à mon bien cordial souvenir,

Emile Picard

J'ai transmis les statuts à M. Schuster.

FIGURE 2.6. IRC President Picard to IMU President de la Vallée Poussin. This is how the IMU was told that its statutes had been approved by the IRC.

second General Assembly, in 1922, the message of Picard's presidential address was to assure the Unions that membership in the IRC did not menace their autonomy. The time was not yet ripe for changing membership clauses. The Swedish proposal to delete all political restrictions was rejected by a large majority.

The third General Assembly of the IRC was held in 1925. Now there was growing feeling on the part of several member countries that the IRC and its Unions could not continue to be considered as truly international as long as certain countries were excluded from their activities. Pressure from various directions was exerted for the restrictions on membership to be waived. This was the principal matter discussed at the General Assembly. President Picard took a cool attitude: *Les événements, dont le monde a été le théatre il y a quelques années, nous ont rappelé durement des vérités trop souvent oubliées. Vous aurez à voir un jour à quelles conditions et dans quelle mesure il conviendra de jeter un voile sur le passé.* (The events of

which the world was the theater a few years ago have reminded us severely of truths too often forgotten. You will see one day under what conditions and to what extent it is appropriate to cast a veil over the past.)

The proposal that all members of the League of Nations be eligible for membership in the IRC, which would have connected the Council with a governmental organization, was at first defeated. Discussion centered on the question of whether the clause limiting membership to Allied and neutral states should be entirely deleted from the Statutes. Delegates of several countries expressed the opinion that this should be done. The British view was expressed very clearly: "Three years ago we opposed the proposal.... To-day we think that the time has come to remove those restrictions. We are strongly of opinion that it would be deplorable to see the Scientific World separated into two camps, and think that all collaboration between scientific men will become difficult if we continue to exclude the Central Powers from our international organizations."

This time the proposal to remove membership restrictions found a majority, twenty-eight against nineteen, with five abstentions. Picard remarked that the amendment of the statutes could be made only with a majority of at least two-thirds of the total number, seventy-six, of the Council's votes; i.e., at least fifty-one votes would have been needed for the change. This would have required almost complete unanimity, since the total number of votes cast was fifty-two. Some of those who opposed changing the statutes[4] found that amendment now was premature but agreed that the restrictions could not be maintained indefinitely [56].

Yet the march of events was now rapid. Favorable political developments took place: In October 1925 the Locarno Treaty was concluded. It eased tensions between France and Germany and led to Germany joining the League of Nations the following year. These events received much publicity and increased optimism. In the IRC, the feeling spread that the very existence of the Council was jeopardized unless the discriminatory membership clauses were removed. The Executive Committee decided to summon an extraordinary meeting of the General Assembly in the summer of 1926, only one year after the third Assembly, to discuss again the question of membership.

Before the meeting, the AMS had adopted the following resolution on 1 January 1926: "The Council of the American Mathematical Society hereby inform the National Research Council that the Society desires to have no official representation on the American Section of the International Mathematical Union after 1 July 1926, unless the International Research Council at its meeting in June amends its rules so that membership in the Union may be entirely international."

---

[4]They were France (5 votes), Poland (4), Czechoslovakia (3), Egypt (3), Belgium (2), and Morocco (2).

Less sharp but in the same direction was a proposal that came in the spring of 1926 from France. Paul Painlevé, a noted mathematician and politician, suggested a joint meeting of four French and four German representatives of scientists in some neutral place. "The impossibility of scientific boycott has been realized, and there is a sincere wish in France for cooperation."[5]

Intense activity preceded the Extraordinary General Assembly. Pressure was exerted by the French government and many colleagues on Picard and other recalcitrant ultras. They began to lose the game. Before the meeting started, it had become clear that the die was cast [34].

On 29 June 1926 the Extraordinary General Assembly, at a meeting that lasted one hour, first unanimously decided to delete from the statutes the stipulation restricting membership for political reasons. After that, the Assembly, instead of discussing further modifications to the statutes, adopted a resolution to invite Germany, Austria, Hungary, and Bulgaria to join the International Research Council and the Unions attached to it. In concluding the meeting, Picard very briefly noted being happy that the Council had been able to emerge from the impasse in which it had found itself [57]. A few weeks later he confessed to Mittag-Leffler, "You know what we have done in Brussels; it was a necessary operation, but I went along with it without enthusiasm" [58]. At the time of the 1928 International Congress, Picard still assumed an anti-German attitude (see Section 2.4).

A major turn of events had occurred in the policy of the IRC. The victors in World War I had decided to forget the past. Optimistic views about the consequences of the resolution were included in the minutes of the meeting of the Extraordinary General Assembly. However, the invitation to Germany, Austria, Hungary, and Bulgaria to join the IRC and its Unions did not bring the results that the IRC desired. Germany did not give a definite answer. Austria, referring to the affiliation of its Academy to the Kartell of German Academies, also did not make up its mind. Bulgaria referred to economic difficulties. Of the invited former Central Powers, only Hungary became a member of the Council in 1928, but it announced that for financial reasons it could not yet join the Unions.

The invitation to Germany to join the IRC had been sent to the German government, since "no national German Academy of Sciences existed." The government advised the Kartell of the Academies to join the Council. The German Foreign Ministry regarded joining as necessary for general political reasons, adding that "it could not be understood abroad why we would not come out from the trenches now, when shots were no longer being fired." The Kartell, however, found unsuitable the interference of politicians in matters where the Academies were sovereign. Unlike the political regime

[5]Painlevé held ministerial posts in French governments several times between 1915 and 1933, serving as Prime Minister in 1917 and again in 1925.

of Germany, the Kartell assumed a negative stand towards the IRC. It did not change its mind in spite of repeated governmental requests and even threats that the Kartell could be overruled and German membership arranged [48].

German scientists had not forgotten the boycott to which they had been subjected. They kept maintaining that the purpose of the IRC had been to impair German science. The French-dominated IRC, still under the leadership of the unrelentingly anti-German Picard[6] and holding all its meetings in Brussels, could not restore to Germany the position it had held in the International Association of Academies. The formulation "to invite" instead of "to admit" was not enough for the Germans to conclude that the reasons for their previous exclusion had been completely annulled. The invitation should have included a guarantee of adequate German representation in the Executive Committee [59].

There was one more reason for the negative German attitude. The meetings that led to the foundation of the IRC and its Unions had been held without the participation of Russia. Once the Russian guns were silent after the civil war, German and Russian scientists indicated interest in cooperative arrangements. They felt a certain affinity as outsiders from the IRC network. In January 1926, the Russian mathematician V.A. Steklov suggested that the old International Association of Academies should be revived [60]. The Kartell was in favor of the idea but proposed that formal initiative come from Russia, which should first seek the support of at least Italy, the United States, and the Netherlands. However, Steklov died in May 1926, and the chances of reestablishing the IAA evaporated. It would have been much to the taste of the Kartell to have an international organization that would comprise both sciences and letters and where the Academies would have a higher status than they held in the IRC. "The Academies and similar societies cannot tolerate any master above themselves" [48].

Soon after the invitation to join the IRC had been issued to Germany, the International Astronomical Union (IAU) approached German colleagues expressing the wish that they become members of the IAU. The brusque answer of the German Astronomical Society disclosed the German point of view: Membership in the IAU was impossible because international cooperation in astronomy had essentially been founded by the Germans, and now the IAU was subject to the IRC.

In the case of the IMU (whose Bureau is not known to have contacted German mathematicians), the nonmembership of Germany in the Council had far-reaching consequences. The IMU had to decide whether to allow the nonmember Germany to attend the 1928 International Congress. The

[6]Picard should have resigned from the Executive Committee in 1925, as a result of the drawing of lots. However, Hale had expressed the wish to retire for reasons of health, and Picard was reelected by the 1925 General Assembly.

negative stand of the Secretary General strengthened the development that ultimately ruined the Union. The story will be unfolded in the following sections.

The 1926 Assembly agreed with President Picard that for the new membership policy, the suppression of a few words from the statutes would make the IRC sufficiently international, and only that was done. Irrespective of the membership question, a comprehensive revision of the statutes was in the air, because the Unions were asking for more autonomy.

The fourth General Assembly of the IRC met in 1928. The Convention under which the Council had been formed was due to expire at the end of 1931. The principal matter for discussion was what action should be taken in the meantime. The general feeling of the Unions had been expressed by W. de Sitter, President of the International Astronomical Union:

> The Unions were created by the Research Council. They have so far been imbued with the respectful veneration that is due from children to their parents. The time comes, however, in all families when the children grow up and are strong enough to take their fortune into their own hands. Parents and children are apt to differ over the exact epoch when this time has arrived, but it is bound to arrive sooner or later. Wise parents rejoice when their offsprings have acquired the strength and wisdom to go their own way; unwise parents regret the loss of power but they wail in vain; the grown-up children will go their own way all the same" [61].

The General Assembly decided to appoint a Committee to consider what changes should be introduced in the statutes of the IRC and its Unions, to take effect on the expiration of the present Convention. For this purpose the Committee should enter into communication with the Unions and other bodies belonging to the Council and present a report to the Executive Committee of the IRC. The General Assembly was favorably disposed to the proposition that the Unions be free to alter their own statutes within the limits permitted by the statutes of the IRC. The Committee prepared a draft of the revised statutes, which was circulated to all the adhering organizations. After considering the comments received, the Executive Committee submitted the final version of the statutes to the General Assembly for approval [61].

This revisory work strengthened the view of the Kartell in Germany that it was in their best interest to wait. They should await the results of the ongoing revision before taking any decision about possible membership in the IRC. "The gradual disintegration of the hostile umbrella organizations [the IRC and the International Academic Union] can be quietly awaited" [42]. Yet, instead of a disintegration, the IRC underwent a smooth transformation.

A new period in the history of the Council began in 1931. The IRC was disbanded and replaced by the International Council of Scientific Unions (ICSU). This occurred at the fifth General Assembly of the IRC and the first General Assembly of ICSU, held jointly in Brussels. The ICSU counts its age from this constitutive meeting, although its statutes did not come officially into force until 1 January 1932. The initial membership of ICSU consisted of nine scientific Unions and forty-one member countries.

The Council was to become in large measure an emanation of the Unions. This was the reason for changing its name. It was explicitly specified that ICSU was to consist of a national scientific organization from each country that had joined the Council, together with the international Unions. Thus the dual membership of the Council, national and scientific, was adopted. As before, the statutes indicated that "country" included dominions and diplomatic protectorates, as well as territories having independent scientific activity. The broad interpretation of the term "country" proved important after the Second World War.

With the formation of ICSU, each of the Unions was given autonomy in the management of its own affairs. It could admit any country to membership irrespective of whether or not that country belonged to ICSU. A Union desiring to join the Council was required to communicate its statutes to the Council. These statutes were required to embody a few specific broad principles [61].

From the very beginning, ICSU was open to scientists from throughout the world. Since 1931, ICSU's principle of nondiscrimination has remained the basis of international science policy. Its implementation in practice has not always been easy, as will appear from the subsequent narrative.

The American astronomer G.E. Hale, who had been one of the chief planners of the IRC in 1918, was elected the first President of ICSU. A mathematician was again elected to the Executive Committee: N.E. Nörlund (Denmark) became one of the two Vice-Presidents.

In Germany, the formation of ICSU did not impress the Kartell. Possible membership was discussed at the 1932 annual meeting, but only the laconic remark, *"... in keiner Weise aktuell"* (of no current relevance) was recorded in the minutes [62]. In the Kartell protocols of the years 1933–1937, ICSU was not mentioned at all. (German international science policy in the 1930s will be briefly discussed in Section 3.3.)

In 1921, the League of Nations had founded the International Commission for Intellectual Cooperation (ICIC)—the *Commission Internationale de Coopération Intellectuelle*—a governmental organization that was in a way a forerunner of UNESCO. Like the League, it was located in Geneva. The first contacts between the ICIC and the IRC had been with a representative of the IMU in 1924. The IMU transmitted the proposal of cooperation to the IRC Executive Committee, which set up a special Committee with de la Vallée Poussin as chairman to study this proposal. According to a later remark by the Secretary General of the IRC, this Committee did

nothing. In the years 1929–1932, the last President of the old IMU, W.H. Young, became interested in the ICIC and suggested direct IMU–ICIC collaboration, without the detour via the IRC/ICSU. A representative of the ICIC was present at the meeting of the General Assembly of the IMU in 1932. It was proposed that the Union work together with the ICIC to find a way out of its crisis. No documents have been found to prove that this really happened. The 1937 General Assembly of ICSU approved of the idea of permanent cooperation with the ICIC, but World War II soon put an end to such hopes. The ICIC was formally dissolved in 1946.

In 1924 a private organization, the International Federation of Intellectual Unions (*Fédération Internationale des Unions Intellectuelles*), came into existence. The principal objective of the Federation was to promote reconciliation in science. The Federation was in correspondence with President Young, but no permanent contact was established with the Union.

2.4 The IMU Separates from the Congresses

The mathematicians followed the change of climate that had taken place in the IRC. The exclusion policy was broken at the ICM in Bologna, Italy, in 1928. The initiative for this development came not from the IMU but from the Italian organizers, who were supported by the opinion of the great majority of mathematicians worldwide.

In Toronto, the IMU General Assembly authorized the Executive Committee to select the site for the 1928 International Congress, a decision to be made by the end of 1926. After Belgium had withdrawn its candidature, the competitors were Bologna and Stockholm. Pincherle, the new President of the IMU, found himself in a delicate position. As an advocate for Bologna, he felt that he should not take part in the decision. On the other hand, as he complained to Mittag-Leffler, with Koenigs neglecting his duties, he had to coordinate the correspondence with the members of the Bureau [49]. It soon became evident that Bologna was the favorite. Koenigs and Treasurer Demoulin went so far as to threaten that if the site of the Congress were to be Stockholm, the unfavorable exchange rate would prevent France, Belgium, Poland, Czechoslovakia, Greece, Romania, Portugal, etc. from participating. In July 1926, Mittag-Leffler yielded in favor of Bologna. Pincherle asked him to preside at the opening session "of the first [after 1912] truly international congress of mathematicians" [63]. Mittag-Leffler died in 1927, however, and this honor fell to another. After the Bureau had formally selected Bologna, in November 1926 Secretary General Koenigs announced the decision to the members of the Union. Pincherle (Fig. 2.7) was given a second important function when the Italians appointed him Chairman of the Executive Committee of the Bologna Congress.

FIGURE 2.7. Salvatore Pincherle (1853–1936). Italian mathematician (functional analysis) who was President of the IMU 1924–1928. As President of the ICM-1928 in Bologna, Pincherle opened the Congress to all mathematicians irrespective of nationality, terminating the discrimination against the Central Powers.

Pincherle's stand on the inclusion of all mathematicians at the Bologna Congress was clear. Already in 1925, before the decision in favor of Bologna had been taken, he wrote to Volterra that unless the next Congress were open to all mathematicians irrespective of nationality, a crisis would undoubtedly ensue. In saying this, he could refer to information that both the American Mathematical Society and the London Mathematical Society would strongly oppose a Congress in which participation was restricted [55]. Moreover, as related in the previous section, in 1926 the IRC invited Germany, Austria, Bulgaria, and Hungary to join the Council and its Unions. Thus the Italian organizers decided to return to prewar tradition and remove all political barriers.

The Italian policy of openness was widely applauded. More than that, Congress organizers were informed by Denmark, Sweden, the Netherlands, Great Britain, and the United States that they would no longer tolerate

discrimination for political reasons and that consequently, their mathematicians would not attend the Congress unless it were unrestrictedly international.

In Germany, the Academy in Göttingen called attention to the invitation to German mathematicians and recommended a positive response [64]. The influential Prussian Academy agreed with Göttingen that individual German mathematicians could attend the Congress on their own responsibility. In fact, this would be in the interests of Germany not only for purely scientific reasons, because German participation would weaken the prestige of the IRC and detach the Council from important international events, and ultimately, the IRC would become superfluous [64]. As regards the IRC/ICSU, this vision did not materialize, but in the case of the IMU it did, as will be related in Section 2.6.

However, difficulties were encountered in Germany. A relatively small but authoritative group of mathematicians, led by Ludwig Bieberbach, from the University of Berlin, launched an action against the Bologna Congress based on the thesis that the Congress was connected with the IMU and the IRC, which were still hostile to German science. In the spring of 1928 Bieberbach sent a letter to all German universities and secondary schools urging them to boycott the Bologna Congress. The prestigious Hilbert responded by sending out a letter of his own: "We are convinced that pursuing Herr Bieberbach's way will bring misfortune to German science and will expose us to all justifiable criticism from well disposed sides.... The Italian colleagues have troubled themselves with the greatest idealism and expense in time and effort.... It appears under the present circumstances a command of rectitude and the most elementary courtesy to take a friendly attitude towards the Congress" [65]. The view represented by Hilbert prevailed, and in Bologna, the Germans formed the largest national contingent after the Italians.

When the storm in Germany had more or less abated, another threat came from the IMU, more exactly, from the Union's Secretary General Koenigs. According to the rules of the Union, which had not been amended, invitations to the Congress could be sent only to mathematicians from countries that were members of the IRC. In Toronto in 1924, this rule had been ignored, as related in Section 2.2 above. But now the problem country was Germany. In view of the fact that it had been eligible to join the IRC since 1926, the participation of Germany should not have caused difficulties. But Koenigs adhered strictly to the rule barring nonmembers of the IRC from the Congress. He expressed his view to Pincherle in a letter of May 1928, in which he made it clear that the Bologna Congress was not a Congress of the Union: *"Dans les conditions où ces convocations ont été faites, on ne peut plus dire que le Congrès de Bologne est un Congrès relevant de l'Union Internationale Mathématique."* He could not recommend that members of the Union take part in the Bologna Congress, and he made his views known to all the members of the IMU in circular letters.

In this controversial situation Pincherle turned to the President of the IRC, Picard. Pincherle went directly to the heart of the matter by stating that in organizing the Bologna conference it had not been possible to adhere to the guiding ideas of Strasbourg and Toronto. The attitude of the entire world was no longer what it had been right after the war; the reasons for exclusion, which at the time may have been considered necessary, were no longer understood by younger scientists. His correspondence of the previous two years was the most evident proof of this. Pincherle continued by mentioning countries, including "most authoritative groups in England and the United States," from where it had been made absolutely clear that a Congress not international in the broadest sense of the word would lead to a general abstention. This was also the opinion of the great majority of his Italian colleagues. Pincherle then discussed the ideological aspect: In order to reestablish unity among scholars who cultivate the purest of all sciences, it was necessary to give the Congress a form permitting the establishment of this unity. To proceed differently would arouse the bitterest criticism against the Union from most scholars of neutral or formerly Allied countries. Referring to the fact that pleas were coming from everywhere to find a solution, Pincherle found that *"le but supérieur justifiera bien quelque dérogation à des articles d'une convention nécessairement précaire! Ces idées, que mes collaborateurs italiens partagent entièrement, nous ont obligés à chercher un tempérament qui serve aussi à éviter à l'Union un résultat qui constituirait un véritable échec."* (The supreme goal justifies some deviation from the paragraphs of a convention that are at any rate precarious! These ideas, which my Italian collaborators entirely share, have forced us to look for a disposition that would also help the Union to avoid a genuine failure) [66].

The desired support did not come from the IRC. In spite of the fact that the Council in 1926 had removed all barriers restricting membership, Picard sided with Koenigs, "in an attenuated form," as the Congress Proceedings stated. Young had heard that Picard's reply was two lines on a postcard asserting that the President of the Council could not attend a Congress at which Germans would be present [67].

No agreement was reached between the IRC/IMU and the Bologna Congress. Nevertheless, the Italian organizers did not alter their policy. The response from the world's mathematical community was unambiguous. With more than 1,100 participants, about 850 of them mathematicians, the Congress was by far the largest ICM to date. There were mathematicians in attendance from thirty-six countries, many of which were not members of the IRC. Despite the protest of Koenigs, fifty-six French mathematicians were present in Bologna, forming the third largest national contingent (after Italy with 336 and Germany with 76). Scientifically, the Congress was a success [66].

At the opening session, Hilbert was met by a standing ovation. "It makes me very happy," he said, "that after a long, hard time all the mathemati-

cians of the world are represented here. This is as it should be and as it must be for the prosperity of our beloved science.... It is a complete misunderstanding of our science to construct differences according to peoples and races, and the reasons for which this has been done are very shabby ones. Mathematics knows no races.... For mathematics, the whole cultural world is a single country" [65].

During the Congress, the IMU General Assembly convened on 9 September 1928 at the auditorium of the Institute of Mathematics of the University of Bologna. According to the minutes, of the twenty member countries, the following thirteen were represented: Belgium, Canada, Czechoslovakia, Denmark, France (ignoring the protest of Koenigs), Great Britain, Italy, Japan, the Netherlands, Poland, Sweden, Switzerland, and the United States of America. Thus the mathematical community had rebelled in force against the "legal" policy represented by the Secretary General.

Honorary Presidents de la Vallée Poussin and J.C. Fields, President S. Pincherle, and Vice-Presidents W.H. Young and H. Fehr were present. Pincherle was chair, and Koenigs being absent, Fehr acted as secretary. Loyal to Koenigs, Treasurer Demoulin was also not present.

In his opening speech, President Pincherle remarked that the meeting was unofficial because the Secretary General had not found it appropriate to summon the delegates, nor had he forwarded the minutes of the Toronto General Assembly. Pincherle then described the difficulties that had arisen from the adopted principle of inviting mathematicians to the Congress without restriction. That is why, he said, the Congress was being held under the patronage of the University of Bologna, and why the invitations had been issued by the Rector of the University, a recognized scientific authority above political suspicion.

The highlight of the meeting was the unanimous approval of the following Resolution: "The members of the International Mathematical Union are extremely grateful to Professor Pincherle for what he has done to make the Bologna Congress successful, and they endorse his action completely. They entrust the study of the present situation to the Bureau of the International Mathematical Union."

Pincherle thanked the Assembly for this manifestation of confidence. But he told the Assembly of his decision to discontinue his presidency of the Union (in the middle of his eight-year term 1924–1932). His resignation was "absolute and irrevocable." After this announcement, he handed over the chairmanship to the Honorary President de la Vallée Poussin. Pincherle's decision to break his term was a loss to the Union. He was untarnished by the 1918–1920 resolutions, which had determined the policy that now had been discarded, and he had proved his mettle in the events of the Bologna Congress.

No elections were held at the meeting. The second part of the session was dedicated to a discussion of the next International Congress. Prague and the Netherlands had expressed their willingness to host it. Since a majority

could not be achieved in favor of either of them, it was decided to renew the approach to the Swiss delegation [68].

A Bureau meeting, presided over by Vice-President Young, was held immediately after the General Assembly. Pincherle pointed out once more that the Union had gotten itself into a difficult situation. One of its main tasks was to organize International Congresses. "However, it is no longer possible to arrange successfully an international meeting that is not accessible to all countries." Yet all members present were in favor the IMU's continued existence. "The Union can be of great service to mathematics, not only in the international domain but also indirectly, through the National Committees, in each member country." Finally, the Bureau decided to call the Union's critical situation to the attention of the International Research Council [69].

The closing session of the Congress was held in Florence. There, R. Fueter's invitation to hold the 1932 International Congress in Zurich was accepted. Thus Zurich became the host city of the Congress for the second time.

The Resolution approved by the General Assembly was clear and left no doubt about the Union's stand in 1928 in support of the principle of universality. But was it the informal status of the meeting that made the delegates wary of making decisions? No action in conformity with the Resolution was recommended. All responsibility was transferred to the Bureau. It was mandated "to study the situation," but as will presently be related, this did not lead to concrete results. This passivity proved fatal to the IMU.

Pincherle and the other Italian organizers of the Bologna Congress very likely rendered an invaluable service to international mathematical cooperation. A strict adherence to the rules of the IRC and the IMU in 1928 might have wrecked the institution of the ICMs. Their decision to open the 1928 Congress to all mathematicians irrespective of nationality instituted a permanent change of policy. In connection with the Zurich Congress in 1932 there was no longer much discussion of who could take part in the Congress. It was taken for granted that mathematicians could and should be invited without any political restrictions. Even the formal rule barring the participation of countries not belonging to the IRC, to which Koenigs had appealed in 1928, had lost its validity. By the time of the Zurich Congress the IRC had ceased to exist, and the Statutes of the IMU were no longer in force.

At the Bologna Congress and afterwards, the feeling was growing that the Congresses and the Union represented two separate forms of international mathematical cooperation. The success of the Bologna Congress was achieved by averting the intervention of the IMU. In his controversial position as President of the IMU and President of the Congress, Pincherle gave priority to the Congress and discontinued his presidency of the IMU [70]. The Congress reestablished a truly international Commission on the Teaching of Mathematics, which the IMU had caused to be dissolved in 1920.

No wonder that doubts about the need and usefulness of the Union were gathering strength.

2.5 The IMU Adrift

With one exception, the Unions approved new statutes that agreed with ICSU's principle of promoting cooperation in research without political restrictions. The exceptional case was the IMU. New and amended statutes were not adopted to replace those that had expired at the end of 1931. At the time of this writing, not all documents concerning the developments that led to the suspension of the Union have been uncovered. Thus some points in this description of the march of events contain an element of speculation.

As a result of the Bologna Assembly, the Union was confronted by administrative problems. The six Honorary Presidents, who were life members, remained members of the Bureau, and so, by statute, did Vice-Presidents Bliss, Fehr, and Phragmén, who had been elected in Toronto in 1924. But what about Vice-Presidents Appell and Young, Secretary General Koenigs, and Treasurer Demoulin, who had been elected in Strasbourg in 1920? Since Pincherle had declined to continue as President, the Union certainly did not have a President. Clearly, there were open problems that had to be solved as quickly as possible.

Honorary President de la Vallée Poussin, who had taken the chair in Bologna upon Pincherle's resignation, coordinated correspondence among the members of the Bureau. In 1918–1920, de la Vallée Poussin had been one of the principal architects of the policy that had barred Germany and other former enemies from mathematical cooperation. At the Toronto Congress in 1924 he had distanced himself from this policy. Now, after Bologna, he confessed that he had never liked it. Picard also participated in the administrative arrangements, without revealing his feelings about the matter.

After some sifting of the various possibilities, a line of action was adopted that rested on the interpretation that the Bologna meeting of the IMU was not an ordinary General Assembly. The statutes by which members of the Bureau served until the second General Assembly following their election were read literally. Since only one General Assembly had convened after the meeting in Strasbourg, all members would stay in the Bureau until the next General Assembly. The decision was taken, but as no explanations were provided, not everyone understood the legal grounds for it.[7]

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[7]The IMU Bureau disregarded the recommendation of the Secretary General of the IRC, Lyons, who advised that the members of the Bureau elected in 1920 leave their posts and that the remaining members choose their successors. Young and Koenigs would then have been forced to retire.

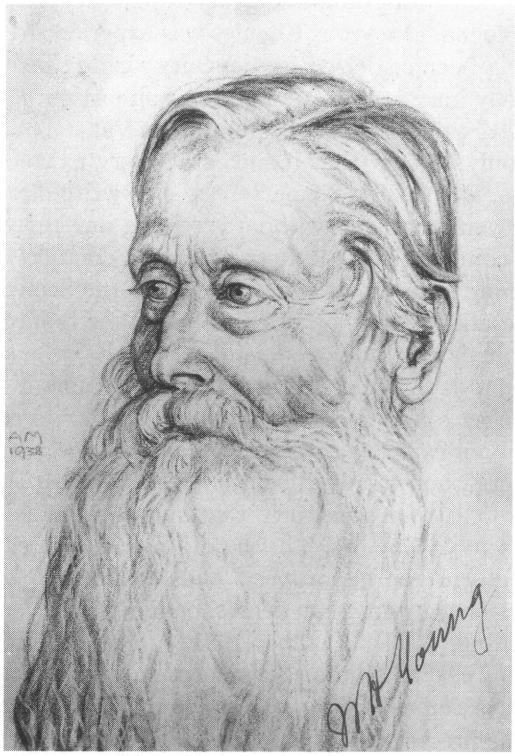

FIGURE 2.8. William Henry Young (1863–1942). British mathematician (real analysis). Young was Vice-President of the IMU 1920–1929 and President 1929–1932. He attempted to reform the International Research Council and fought against heavy odds to try to save the IMU.

The administrative problems were thus narrowed to the election of a President. In order to handle this question, the Bureau used its statutory emergency powers to provide for filling unexpected vacancies. To find the person was no problem: Vice-President Young was the sole candidate. Preliminary discussions that had been carried on in Bologna encouraged de la Vallée Poussin to send a letter to the members of the Bureau proposing the election of Young. Every reply was in favor. Ultimately, all except Phragmén replied; Koenigs himself did not write, but Picard in his answer stated that he had been authorized to speak on behalf of Koenigs as well. In January 1929, Young (Fig. 2.8) was informed that he was the new President of the IMU [71]. He was under the belief that he was President without a Secretary General and a Treasurer until Fehr rectified his view.

In a way, Young had not been so wrong. Officially, Koenigs was still Secretary General, but for all practical purposes, the Union had to do without

his office. The policy of discrimination that Koenigs represented had been abandoned in Bologna. Moreover, Koenigs was experiencing problems with his health. Having been criticized for passivity already before Bologna, he now became wholly inaccessible. Young, in his almost pathetic attempts to obtain official IMU writing paper, wrote to de la Vallée Poussin, Pincherle, and Demoulin, only to hear that if such stationery existed, it was in the hands of Koenigs. Eventually, Young ventured to write directly to his Secretary General, even twice, but without receiving any reply. The isolation of Koenigs was confirmed by Sir Henry Lyons, Secretary General of the IRC. He told Young of his having sent a letter to the Secretary General of the IMU, but he added that "as Koenigs has never replied to any of my previous letters, he is not likely to do so to this."

In this situation, de la Vallée Poussin wrote to Young in February 1929 that he should select a new Secretary General as different as possible from Koenigs, who did not care to answer letters and who more than anyone else was responsible for the present difficulties. He proposed that Koenigs be replaced by Fehr [52]. Young answered that he was reluctant to take action without the consent of Koenigs. This he did not ask. In early 1931, de la Vallée Poussin returned to his proposal and informed all members of the Bureau about his suggestion that Fehr should replace Koenigs. Koenigs, who had been ailing, died in October 1931. A new Secretary General for the Union was not elected before the forthcoming General Assembly [73].

Young may have committed a serious error in not replacing the Secretary General. The presence of Koenigs in the Bureau not only meant that secretarial work was blocked, but as a symbol of the discrimination policy now condemned, it cast a shadow over the Union. Koenigs's deteriorating health would have provided a face-saving reason for retirement. The pragmatic Fehr, on the other hand, had an excellent record as promoter of international interests in the Commission on the Teaching of Mathematics. After 1928 he was again proving his efficiency and diplomacy in reviving a good working atmosphere in the Commission (Section 3.2). Fehr as Secretary might have been of great assistance to Young.

The new President Young and his wife, Dr. Grace Chisholm Young, also a mathematician, had lived in Germany before the war. They had friends there, and they felt a deep affection for Felix Klein, of whom they spoke as a revered master and friend. The loss of their son in the war was a heavy blow for them.

Young had participated in 1919 and 1920 in shaping the policy of discrimination against the defeated countries. However, he changed his mind over time. At the 1924 IMU General Assembly in Toronto, Young was in the British delegation that endorsed the resolution requesting the IRC to consider whether political restrictions on the Council's membership might be removed. Yet he was not as vehemently against the discrimination policy as was Hardy. In 1924 Young was President and Hardy Secretary of the London Mathematical Society. At Hardy's insistence, the Society did not

send delegates to the Toronto Congress, while Young, a Vice-President of the IMU, would not have gone so far [74].

Young was in contact with Fehr, a Vice-President of the IMU since 1924 and an advocate of unrestricted internationalism. Both lived in Switzerland, Fehr in Geneva and Young not far away, near Lausanne, where he was a permanent resident. By a third person's recent account, Fehr's son, Dr. J.-J. Fehr, remembered very well that his father was in disagreement with Young about the reintegration of certain countries into the IMU, Germany in particular. However, this recollection is not in conformity with Young's actions as President of the IMU, and if true, must refer to earlier years. Asked about this in 1995, Dr. Fehr answered only that Professor Young was a friend of his father and that the two worked closely together in many activities [75].

In 1929 Young was a retired professor who, although no longer engaged in creative mathematical research, was still full of energy. He began his presidency in a mood of great optimism. Two days after being told about his election, he wrote to Constantin Carathéodory in Munich, concluding his letter with the words, "I hope my German colleagues will see in my election to the office a good omen for the future" [76]. The tenor of his letter to the Secretary General of the IRC was the same: "I have received a number of letters expressing confidence in my power to bring the good ship into port and to secure final peace for our science" [77].

The philosophy that guided Young's actions soon crystallized: The root of all evil lay with the International Research Council, which had to be radically reformed. It was an opportune time to do this. In the 1928 General Assembly of the IRC, a Committee had been set up to draft new Statutes, and both National and Union members had been requested to submit their proposals (Section 2.3). Young learned that in 1922 the President of the IMU, de la Vallée Poussin, had been appointed to represent the Union in the Executive Committee of the IRC during the three-year period 1922–1925. In 1929 de la Vallée Poussin still held this position, because the IMU had simply forgotten to take up the question of representation. With de la Vallée Poussin's consent, in 1930 Young replaced him as a member of the Executive Committee of the IRC.

Young set to work and soon became obsessed with the idea of reshaping the IRC. With the help of his "provisional private secretary," i.e., his wife, he prepared a set of new statutes for the Council [78]. From available sources the conclusion can be drawn that he acted alone, without consultation with other members of the IMU Bureau. He presented "Young's Draft Statutes," as he called them, to the meeting of the Executive Committee of the IRC in July 1930. Already on the first line they differed from the Official Draft Statutes. Young, wishing to retain the existing name of the Council, criticized the proposed new name, "Central Council of International Scientific Unions." (It was subsequently changed to "International Council of Scientific Unions.") Young was under the impression that a Commit-

tee, including Young himself, had been appointed for the consideration of Young's Statutes in relation to the Official Draft Statutes. When he heard nothing about when this Committee was to meet, Young grew impatient and was told that there was no intention of summoning it. Even though some of Young's proposals had been included in the Official Draft Statutes, Young was far from pleased.

In November 1930 Young submitted a thirty-five-page memorandum in which he analyzed in great detail the IRC and its Statutes [79]. Its tone became apparent from what Young wrote about the Official Draft Statutes: "Was it necessary to appoint a commission of fifteen persons, representing eleven countries, to make such trifling changes in the Original Statutes. A further scrutiny suggests a lack of interest on the part of the commissioners in any changes...." Young took note that his proposals had been heeded at some points, but he wrote, "In so doing, however, sacrifice is made of the force and brilliance of the wording in C [that is, in his own Draft Statutes]."

Of his own role in the Union Young wrote that "he was not only active in its foundation but had been heart and soul in the interests of the body during the subsequent years. It was not, however, until a crisis in the affairs of that Union called Professor Young, early in 1929, to the Presidency with almost dictatorial powers, with a mandate to save it single-handed from shipwreck and to render it really international and scientific in character, that he began to realise both the potential importance and the actual impotence of the parent organism, the I.R.C."

Of Germany, Young wrote, "...the hesitation of Germany to enter into the International Mathematical Union was largely conditioned by its unwillingness to put itself under the heel of the IRC." Bieberbach, who had urged a boycott of the Bologna Congress, wrote in June 1929 that Germany's membership in the IMU would be possible if every reference to the Council were eliminated from its statutes, if no members were to have privileges for political reasons, and if no one could be excluded a priori from membership for political reasons. The complete separation of the IMU from the Council would not necessarily be required [80].

No productive dialogue developed between Young and the IRC. In July 1931 the IRC became ICSU, as related above. From a historical perspective, this change was an important event. In the opinion of Young, however, the change only scratched the surface, being far from what it should have been. A sense of despair appears to have overwhelmed Young.

Parallel to his work in molding the IRC through Young's Statutes, Young undertook extensive travels in Europe. Of the purpose of his journeys he remarked that by consulting the chief savants and organizers he hoped to enlarge his own ideas by listening to their views and, on the other hand, to raise an interest in the affairs and constitutions of the IRC and the IMU. Young had no doubts about how to accomplish this. He spent part of the summer of 1929 in London arranging not only visas for the countries he would be visiting, but audiences with their kings and prime ministers as

well. He made two trips, at his own expense. The first, from September to November 1929, was to Poland, Austria, Hungary, Yugoslavia, Bulgaria, Turkey, Greece, and Italy, while the second took place between April and June 1930 and included Germany, Denmark, Sweden, Finland, Estonia, Latvia, and Czechoslovakia. The trips were a great personal success for Young. He met the king of Bulgaria and ministers and leading scientists in all the countries he visited. As a tangible result of his trips, some countries did join the Union or expressed the intention to do so in the near future. But the main problem, the enrollment of the Germans, remained unsolved [81].

In light of Young's preserved papers, it is striking how little Young was directly concerned with the affairs of the IMU after the administrative routines—such as the status and composition of the Bureau and election of the President—had been settled in 1929. His only policy paper was a joint memorandum with de la Vallée Poussin that was sent to the members of the IMU Bureau in February 1931 [82]. It was not a well-conceived document. It was dispatched only ten months before the statutes of the IMU were due to expire. Revised statutes should necessarily be prepared for the 1932 General Assembly, at which meeting the Union should be put on a new, apolitical, track. Yet this forthcoming, highly important meeting was virtually bypassed in the memorandum.

The memorandum consisted of ten points. One of these was de la Vallée Poussin's reiterated proposal, mentioned earlier, that Fehr be appointed Secretary General of the Union. Another was the suggestion to complement the name of the Union by replacing the word *mathématiques* by *mathématiques pures et appliquées*. It was evidently not noticed that the noun *mathématiques* did not appear in the name *Union mathématique internationale*. As many as four of the ten points dealt with the IRC. In view of what was to happen soon to the IMU, the concern about the future of the Council and the appeal that the Union should do its best to prevent the Council from dying indicates a poor grasp of reality.

International Congresses were discussed at two points. The proposal that cooperation of the IMU with Congress organizers should be studied, keeping in mind the possibility of increasing the Union's role, was reasonable, and it was actually taken up again in the late 1950s. But in 1931 the timing was highly unsuitable for such considerations. There was a widespread feeling among mathematicians that the Bologna Congress had been a success because the attempts of the IMU to interfere with the arrangements had been repulsed.

Concerning the IMU statutes there was only the remark that since these would expire at the end of 1931, amendments must be proposed in good time (*en temps utile*). I have not found any document to show that even later, Young or somebody else prepared new Draft Statutes for the National Committees to be discussed at the meeting of the General Assembly.

In sharp contrast to Young's hectic activity during his first presidential years, the collection of his papers that relate to the IMU or ICSU contain

almost nothing from the year 1932. His stamina seems to have run out. With no Secretary General, the Bureau of the Union was largely paralyzed at the critical time preceding the General Assembly.

The explanation that Young's efforts to save the IMU were undone by the IRC loses credibility in the face of the existence of other Unions that were not affected by the Council. Might results have been different if Young had concentrated his work on the IMU instead of devoting his time and energy to reforming the IRC? Young was a lone thinker, but at this stage the Union needed a pragmatic administrator. Young's cooperation with the members of the Bureau was limited. His numerous letters do not indicate that he had been in contact with his American colleagues, although he must have been aware of the hostile attitude of the American Mathematical Society towards the IMU. Fehr as Secretary might have been of assistance, although there is no record that as Vice-President, Fehr, or any other member of the Bureau, showed much activity. Inadequate preparation for the 1932 General Assembly may have contributed to the decision to suspend the Union, as will presently be related.

Young's work in the IMU was noted in the obituary that Hardy wrote of him [74]. From his actions as President of the IMU Hardy gave Young full absolution. In Hardy's opinion, there was no doubt that Young had thought he could use the position of President to do real service to the cause of international cooperation and that he had worked wholeheartedly to that end. Hardy found that Young, though the objects of his activity were irreproachable, was "carrying them on" under an impossible handicap. The statutes of the IRC had been inspired largely by men "anxious to direct them towards a boycott of ex-enemy nations." According to Hardy, Young never sympathized with these feelings. As President of the Union, Young had done his best, but the case was hopeless.

2.6 Suspension of the IMU

The IMU General Assembly convened in Zurich on 11 September 1932 under circumstances that were not encouraging. The official minutes prepared by the Secretary of the meeting, Georges Valiron, from France, have not been found, but a résumé of them written by Fehr is available [83]. In accordance with the policy adopted by the IMU Bureau, Valiron, disregarding the meeting of the IMU in Bologna, called the Zurich meeting the Third General Assembly of the International Mathematical Union.

Valiron reported that the Union had twenty-one member countries and that Germany and Austria, as well as Finland and Romania, were prepared to study the question of membership. The meeting was attended by the delegates of seventeen member countries—Belgium, Canada, Czechoslovakia, Egypt, France, Greece, Hungary, Italy, Japan, the Netherlands, Norway,

Poland, Spain, Switzerland, the United Kingdom, the United States, and Yugoslavia. In addition, Denmark, Germany, Romania, and the International Commission for Intellectual Cooperation were represented through observers.

Additional information about the proceedings is provided by a report that the U.S. delegate R.G.D. Richardson, the long-time (1921–1940) Secretary of the American Mathematical Society, wrote for the AMS [84]. Of the purpose of the General Assembly Richardson wrote, "Representatives of the various countries had been invited to a session to discuss what steps, if any, should be taken to perpetuate the organization." The sentiment of the American delegation, consisting of C.N. Moore, Richardson, Virgil Snyder, and Oswald Veblen, was that a permanent international organization had no problems important enough to warrant its existence. This drastic point of view was forcefully pursued by the Americans. Were an international organization in mathematics to continue, it should be divorced from all connections with national governments, and the invitation to the next Congress should be accepted by the present Congress rather than by the Union.

The delegates were aware that the old statutes were not in force and that consequently, the main task of the General Assembly was to adopt new ones if the Union were to continue its existence. Admission of members was no longer an ideological or administrative problem. Complete openness was now a matter of course. The old stipulation that "the admission of countries to the Union shall be subject to the regulations of the IRC" had lost all validity. The IRC no longer existed, and its successor, ICSU, emphasized that the Unions could admit members irrespective of whether or not the country belonged to ICSU.

There is almost no information available about what steps the Bureau of the Union had taken prior to the meeting in preparation of new statutes. Valiron's report and Fehr's protest against the suspension of the Union [85] can be so read that the Bureau had suggested some changes. The proposed amended statutes should have been sent to the National Committees for their consideration. However, from the course of the meeting it is possible and even likely that the Bureau had failed to do this. When new statutes were discussed, the Americans announced that they had no mandate to vote on them, and their view was shared by other delegates. Such action was legitimate if the National Committees had not been consulted. Confusion followed. By Valiron's report, the Americans, O. Veblen and N. Wiener in particular (who, according to Richardson's report, was not a U.S. delegate), directed strong attacks against the Union, which, they maintained, was useless. Sharp criticism was also expressed by Schouten (the Netherlands), Watson (U.K.), and Harald Bohr, who was allowed to be present and speak in the name of Denmark, even though Denmark had withdrawn from the Union in 1930. The Union was defended by Hostinsky (Czechoslovakia), Zaremba (Poland), and Fueter (Switzerland). The debate led nowhere.

Finally, it was proposed that an international Commission be set up to investigate the question of permanent international collaboration in the sphere of mathematics and to present its conclusions to the following International Congress. During this period, the present Union would be dissolved. According to Fehr, the official text read, *Pendant la même période, l'Union actuelle serait mise en liquidation.* This proposal was accepted by the General Assembly with twenty-three votes in favor, sixteen opposed, and five abstentions. The assets of the Union were to be frozen pending a decision on the formation of an organization analogous to the IMU [83]. (This provision was not actualized until 1952 (see Section 5.3)).

The decisions of the Zurich meeting were received with mixed opinion. Young felt disappointed and disillusioned, the more so as he was bypassed when members were elected to the Commission to study the possibilities of founding a new Mathematical Union. Vice-President Fehr submitted a written protest: "This result has painfully surprised all those who have followed the efforts of the Bureau to enlarge the circle of member countries. The proposed modifications for the revision of the statutes would have removed exactly the objections coming from countries still remaining aloof.... The reproach that the Union has done nothing and that it is useless is unfounded" [85]. Among the French delegates there was indignation about the decision taken [86]. On the other hand, the *Semicentennial History of the AMS* says about the outcome of the voting, "This caused rather general rejoicing" [37].

The General Assembly authorized Fueter, President of the 1932 Congress, to assign members to the Commission to study the question of permanent international collaboration in mathematics. After consultations with E. Cartan, Severi, Veblen, and Weyl, he appointed F. Severi (Rome) Chairman of the Commission and the following members: P.S. Aleksandrov (Moscow), H. Bohr (Copenhagen), L. Fejér (Budapest), G. Julia (Paris), L.J. Mordell (Manchester), E. Terradas (Madrid), Ch. de la Vallée Poussin (Louvain), O. Veblen (Princeton), H. Weyl (Göttingen), and S. Zaremba (Cracow) [87].

There are differing interpretations of what exactly happened to the IMU in Zurich. Severi's Commission was given the task of studying the general question of permanent international collaboration in mathematics. The revival of the IMU was not explicitly mentioned. The Royal Society recorded the "dissolution" of the Union, and in October 1932, ICSU's Secretary General, Lyons, used the same word in reporting the dissolution of the IMU to the Council. But there was a deadline: It was decided to put the Union into liquidation "until the next Congress." According to the report of the American Mathematical Society, the General Assembly voted that the Union would be in abeyance until the ICM-1936. Fehr was explicitly of the opinion that the Union had been only provisionally suspended. An extreme view in this direction was represented by Gaston Julia, Vice-Chairman of Severi's Commission. He believed that the Commission was in charge of the

Union, which remained in existence until the 1936 Congress would determine its fate. As late as February 1936 Julia recommended to the French Academy of Sciences that it continue paying the customary contribution to the IMU [88]. In view of the negative decision of the 1936 Congress, the question of whether the IMU was dissolved in 1932 or just temporarily suspended is academic. For all practical purposes, the IMU ceased to exist in September 1932, almost exactly twelve years after its foundation.

The American delegates played a prominent role in the last act of the IMU in Zurich. In the history of the American Mathematical Society a remark was made on the Society's role "in smashing the International Mathematical Union" [37]. Yet for an understanding of the reasons for the fall of the Union, the whole history prior to 1932 must be taken into consideration.[8]

The introduction of politics into the IMU was the underlying cause of its problems. It caused friction that was sensed from the very beginning. In such a situation it was fatal that the Union could not offer much mathematical attraction. Instead, political discussions occupied a large part of the Union's energies, creating disagreements and tensions that increased with the years. The negative development was amplified by the events related to the Bologna Congress.

In Zurich the prevailing opinion was to scrap the old IMU, which had been a failure, and to start with a clean slate. History cannot be played a second time, but that may have been a good solution. Advice for the future was given by Hermann Weyl in his address at the Zurich Congress. Weyl condemned strongly the policy the IMU had followed and emphasized the need in the future to keep politics away from mathematics. His words were heeded after World War II, when the Americans started the work to reestablish the IMU.

The Zurich Congress, with close to seven hundred ordinary members, had an independent existence largely outside the stormy events of the Union. The largest national contingents were from Switzerland (140), Germany (111), France (68), the United States and Canada (68), Italy (63), Great Britain (38). The Congress was opened in the main building of the Federal Institute of Technology by R. Fueter, Chairman of the Organizing Committee, who was elected President of the Congress. Recalling that thirty-five years earlier the Federal Institute of Technology had hosted the first International Congress of Mathematicians, he greeted by name some of the participants who had been present in 1897, among them the President of the ICM-1897, Geiser, and the former IMU Presidents de la Vallée Poussin

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[8] *Si le hasard d'une bataille, c'est à dire, une cause particulière ruine un Etat, il y avait une cause générale qui faisait que cet Etat devait périr par une seule bataille.* (If the hazard of a battle, that is to say a particular cause, ruins a State, then there was a general cause that made this State to perish in a single battle.) (Montesquieu, *Grandeur et Décadence des Romains*, chapter XVIII.)

and Pincherle. And as de la Vallée Poussin had done in 1924, Fueter reiterated Hurwitz's words of 1897 concerning the aim and character of an International Congress of Mathematicians [87]. (Cf. Section 1.2.)

3

Mathematical Cooperation Without the IMU (1933–1939)

Suspending the IMU did not mean the end of organized international collaboration in mathematics. As before, International Congresses of Mathematicians would be held every four years. The Zurich Congress accepted the Norwegian invitation to hold the ICM-1936 in Oslo and decided to award there for the first time two gold medals (later called Fields Medals) for outstanding achievement in mathematics. The International Commission on the Teaching of Mathematics worked well and in good spirit until the outbreak of the Second World War.

On the other hand, the darkening political sky was reflected in mathematics. The attempts made in 1933–1936 to reestablish the IMU were not successful. The profound changes in the world's mathematical environment caused by World War II actually go back to the year 1933, when the exodus of mathematicians from continental Europe began.

3.1 The Fields Medals

The Fields Medal has become the most distinguished international mathematical award. It is often referred to as the Nobel Prize of mathematics. The question is frequently asked why Alfred Nobel did not include mathematics among his fields of recognition. There is a widespread rumor that the reason was the personal conflict between Nobel and Mittag-Leffler, and some arguments have been presented in support of this view [89]. However, no documentary evidence has been found to indicate that Mittag-Leffler

may have been the reason for Nobel's decision not to institute a prize in mathematics. Nobel may have thought that mathematics did not contribute enough to the benefit of mankind to merit a prize [90].

The lack of the Nobel Prize in mathematics was strongly felt by J.C. Fields, the Chairman of the Canadian Committee of the International Congress of 1924. As related above, the Committee followed the policy of the IMU in not allowing mathematicians from the Central Powers to participate. From Fields's comments it would appear, however, that he had mixed feelings about the Union's exclusion policy. When he expressed his idea about the need for a prize in mathematics, he emphasized from the beginning that the prize should be truly international, without any restrictions.

Fields's illness delayed the publication of the Proceedings of the Toronto Congress, which appeared four years later, in 1928. After that, some more years passed before the accounts of the Congress could be closed. But in 1931, the Committee of the International Congress, still chaired by Fields, reported that there was a balance of 2,700 Canadian dollars on hand after meeting the expenses of the Congress and the cost of printing its Proceedings. The Committee resolved that the sum of 2,500 Canadian dollars should be set apart for two medals to be awarded in connection with successive International Congresses of Mathematicians. These funds were to be held in Toronto in an account known as "The International Congress 1924 Medal Fund."

A memorandum signed by Fields that outlined the procedure, principles, and underlying philosophy of the award was accepted by the Congress Committee at its meeting in January 1932 [91]. In this document Fields wrote, "It is proposed to found two gold medals to be awarded at successive International Mathematical Congresses for outstanding achievements in mathematics. Because of the multiplicity of the branches of mathematics and taking into account the fact that the interval of such Congresses is four years, it is felt that at least two medals should be available. The awards would be open to the whole world and would be made by an International Committee."

Fields then continued, "As things are at present a practicable course of procedure would seem to be for the Executive Committee of a Congress to appoint a small International Committee authorized to add to its number and call into consultation other mathematicians as it might deem expedient. The Committee would be expected to decide on the ones to whom the awards should be made some three months in advance of the following Congress.... The presentation of the medals would constitute a special feature at some general meeting of the Congress."

Fields thus preferred that the Congress rather than the IMU handle the award, but he added, "In the above arrangements the role of the Organizing Committee [of the Congress] might be taken over by the Executive of the International Mathematical Union at some time in the future when that organization has been generally accepted." Fields seems to have tacitly

disapproved of the existing state of affairs of the IMU and to have expressed the wish of a better future.

In the 1950s, the Union gradually took over the management of the Fields Medals. Since the ICM-1954, the President of the IMU has been the Chairman of the Committee that selects the recipients. (For the ICM-1994, it was exceptionally the Vice-President, for reasons to be explained in Section 11.3.) For the ICM-1962, when the scientific program of the ICMs had become an affair of both the IMU and the Organizing Committee of the host country, the joint Consultative Committee appointed the members of the Fields Medal Committee. In August 1962 the final step was taken when the IMU General Assembly authorized the IMU Executive Committee to take over the arrangements for the award of the Fields Medals. It then became a rule that the President of the Union acts as Chair of the Fields Medal Committee, which is appointed by the Executive Committee of the IMU. (Cf. Sections 7.4 and 7.5.)

Of the nature of the prize, Fields wrote, "In coming to its decision, the hands of the International Committee should be left as free as possible. It would be understood, however, that in making the awards, while it was in recognition of work already done, it was at the same time intended to be an encouragement for further achievement on the part of the recipients and a stimulus to renewed effort on the part of others." His concept was similar to that of Nobel (in the case of the prizes in the sciences), who emphasized that the recipients should carry on research. In the actual awarding, the prizes became different. The Nobel prizes came closer to being rewards for past achievement than assistance for the promising. In contrast, the Fields Medals were regarded as prizes for young mathematicians, and since 1966, "young" has been explicitly interpreted to mean "not over forty years old" (cf. Section 8.2).

Fields expressed rather detailed wishes about the medal itself, of its size and gold content, suggesting that the language to be employed be Latin or Greek. The medals should be of a character as purely international and impersonal as possible, and there should not be attached to them in any way the name of any country, institution, or person.

The medal (Fig. 3.1) is fourteen karat gold. Designed by the Canadian sculptor Robert Tait McKenzie, it represents Archimedes. In conformity with the ideas of Fields, it carries texts in Latin: *Transire suum pectus mundoque potiri* (To transcend one's human limitations and master the universe) on the face side, and *Congregati ex toto orbe mathematici ob scripta insignia tribuere* (Mathematicians gathered together from the whole world honor noteworthy contributions to knowledge) on the reverse side. Fields would probably have been opposed to the Medal being named after him, which occurred after his death.

With the plans in Canada completed and accepted, Fields began preparations to present the proposal for the medal to the 1932 Congress in Zurich. However, he fell ill and died in August 1932, one month before the Con-

FIGURE 3.1. The Fields Medal, awarded for the first time in 1936 at the International Congress in Oslo.

gress. At the closing session of the Congress on 12 September 1932, the offer of the late Professor Fields that the ICM award every four years two gold medals was accepted with thanks. In accordance with the memorandum of Fields, the Executive Committee of the Congress elected a committee consisting of George D. Birkhoff, Carathéodory, E. Cartan, Severi, and Takagi to select the two 1936 winners [87].

Fields made posthumously a personal contribution towards the Medal. Under the terms of his will, the residue of his estate was set aside as a fund, named the "Fields Trust Fund," for the purpose of providing prizes to be attached to the Medals. For decades, until the ICM-1983, the cash prize was 1,500 Canadian dollars. An essential increase to the funds backing the Fields Medal took place in the late 1970s, when the 1974 International Congress in Vancouver transferred its surplus funds for this purpose. Later developments concerning the Fields Medals will be discussed in Section 9.3.

3.2 Collaboration in Mathematical Education

Before the Second World War, the ups and downs of the IMU and the International Commission on the Teaching of Mathematics—called simply the Commission here—were complementary to each other with odd regularity. The Commission was founded in 1908 and worked well until the First World War. During that period an International Mathematical Union was not regarded as necessary (Section 1.3). In 1920 the IMU was founded, and simultaneously, the Commission was instructed to dissolve itself. The IMU worked in cooperation with the International Congresses of Mathematicians until 1928. Then it became separated from them, which greatly contributed to its suspension in 1932. Attempts to form a new mathematical Union were abandoned in 1936. The Commission, in contrast, was revived in 1928 and worked in harmony across national borders, with Germany as a member, until the outbreak of war in 1939.

This account might give the impression that the failure of the old IMU was, after all, not so much due to the political world in which it lived. However, the IMU and the Commission cannot be directly compared. The Commission was a much looser organization than the IMU, which was a member of the IRC/ICSU family. The Commission was connected not with the IMU, but with the International Congresses. Each Congress gave it a mandate for the period between two Congresses, i.e., for four years, and appointed a Committee to coordinate its activities. Members of the Commission were delegates who represented countries participating in the Congresses, each country or group of countries having one delegate. The activities were largely project-oriented. Each member country paid a fixed contribution directly to the Secretary General of the Commission; during 1929–1932 this was 400 Swiss francs. The official languages were English, French, German, and Italian. The official organ of the Commission since 1908 was the journal *L'Enseignement Mathématique.*

Until 1920, Germany played an active role in the Commission, with Felix Klein as President. In accordance with the current policy, the IMU ordered the Commission to be dissolved in 1920. The 1920 and 1924 Congresses did not discuss the establishment of a new Commission. In 1928, returning to the earlier system was again possible. The Bologna Congress simply renewed the old mandate of the Commission. Klein had died in 1925, and the American former Vice-President D.E. Smith was elected as the new President. (This has been the only time that the President of the Commission was not a research mathematician, but the holder of a chair in mathematical education.) Other members of the new Central Committee were Vice-Presidents G. Castelnuovo (Rome) and J. Hadamard (Paris), Secretary General H. Fehr (Geneva), and W. Lietzmann (Göttingen). Lietzmann had been a close assistant of Klein in educational matters.

Four years later, the 1932 Congress in Zurich requested that the Commission continue its work. Hadamard became the new President, and Fehr

continued as Secretary-General and Treasurer. (A list of the members of the Central Committees in 1908–1936 is given in the Appendix, Section 5.)

In the last prewar International Congress, in Oslo in 1936, the Commission was once more given a green light. The topic discussed in Oslo was "Present trends in the teaching of mathematics." According to a report by Fehr [92], the surveys presented attempted to provide a purely objective view of the current state of mathematics teaching; the Commission did not wish to impose any international uniformity, but only to illuminate new trends and to help facilitate progress. There is no mention either in Fehr's report or in the Congress Proceedings that new officers were appointed to the Commission.

In retrospect, the period 1928–1939 was not as dynamic and successful as had been the active years 1908–1914. External conditions were not favorable. A worldwide economic depression began in 1929 and lasted several years. This may have been the reason for the relatively low interest in educational innovation and expansion.

Of the working conditions of the Commission, Fehr wrote in his report [92], *"Au moment où, dans d'autres domaines, la coopération internationale rencontre encore des obstacles, nous sommes heureux de pouvoir faire constater ici que les travaux de la Commission ont pu se poursuivre dans un excellent esprit de compréhension et de collaboration."* (At a time when in other domains international cooperation still meets obstacles, we are happy to be able to say that the work of the Commission has continued in an excellent spirit of understanding and collaboration.)

After the Second World War, the Commission was detached from the Congresses and became a subcommission of the IMU. This happened in 1952 on the initiative of the indefatigable Fehr. Two years later the Commission adopted the acronym ICMI (Section 5.4).

3.3 A Failed Attempt to Found a New IMU

As related in Section 2.6, the action to put the IMU into liquidation was connected with the decision to set up a Commission to study anew the question of permanent international collaboration and present its recommendations to the 1936 International Congress. The Commission formed a smaller Executive Committee. According to the Proceedings of the Oslo Congress, this Committee consisted of F. Severi (Chairman), W. Blaschke, C. Carathéodory, G. Julia, and H. Weyl. The preponderance of German professors is conspicuous: Blaschke, Carathéodory, and Weyl. (The first two had not been appointed to the larger Commission in Zurich; Weyl left Germany in 1933.) This choice of members presumably reflected the fact that Germany had been and would remain the key problem.

Before the Oslo Congress, the Committee met twice, in Rome in March 1934 and in Paris in February 1935. The outcome was disappointing in that difficulties preventing the foundation of a new union were found to be insurmountable. Of this the members of the larger Commission were informed. In the hope that a solution could be found in discussions attended by all members of the Commission, two meetings were held during the Oslo Congress.

Written minutes have not been found, but the mere fact that two meetings were held in Oslo seems to indicate that the Commission had not given up the possibility of a positive recommendation. Severi was not present, because Italy had boycotted the Oslo Congress as a protest against international sanctions imposed on it because of its invasion of Abyssinia. The acting Chairman, Julia, said at the closing session of the Congress that they found the circumstances now even less favorable than in 1935 for the organization of an International Mathematical Union. The official recorded statement of the Commission was terse: *"La Commission nommée par le Congrès de Zurich a vivement regretté l'absence de son président, Severi. Elle n'a pu, pour diverses raisons, arriver à un accord unanime sur la question d'une organisation internationale des mathématiciens. Elle souhaite que dans l'avenir la question posée puisse recevoir une solution."* (The commission appointed by the Zurich Congress regrets deeply the absence of its chairman, Severi. For various reasons, it has not been able to arrive at a unanimous agreement about an international organization of mathematicians. It hopes that in the future this question might find a solution.) To this report Julia added the remark that he considered an international organization of mathematicians very useful for mathematics and for mathematicians. The Congress endorsed unanimously the report of the Commission. The IMU was thus finally terminated [93].

The available documents do not tell why a recommendation to create a new Union was not made. There may have been traces of discontent against the passive and useless IMU, which had been voiced so loudly in Zurich only four years earlier: "A permanent international organization has no problems important enough to warrant its existence." But the weight of the unfavorable political developments must certainly also have made themselves felt.

Germany remained a problem. It had not joined the IRC or later ICSU, although it had been invited to do so as early as 1926 and the German academies kept declaring that German scientists were willing to participate in international scientific cooperation. Germany took part in the work of the International Commission on the Teaching of Mathematics, and the German Mathematical Society had concluded a reciprocity agreement with the American Mathematical Society in 1931. Even Bieberbach, who had urged a boycott of the Bologna Congress, had slightly mollified his stand about joining the IMU, as mentioned in Section 2.5. German observers present at the meeting of the 1932 IMU General Assembly gave the nonde-

script promise that German mathematicians were ready to study the issue of joining the Union.

Hitler's rise to power in January 1933 soon changed all aspects of life in Germany. The academies and universities, which had been under the jurisdiction of the individual states and which enjoyed academic autonomy, were brought under the rule of the Reich Minister of Science, Education, and Popular Culture.[1]

The official German ideology was not in harmony with that of ICSU and its Unions. The view that scientists should keep their politics separate from their science was declared to be fundamentally in error, because National Socialism was a Weltanschauung. The new journal *Deutsche Mathematik* stressed German nationalism and was blatantly anti-Jewish (but it also contained good mathematics) [94]. ICSU remained unacceptable to Germany, apparently because of the old animosity, whereas there arose contacts with some ICSU Unions. In 1938, the Prussian Academy recommended German participation in the activities of the Unions but not membership in ICSU [95]. In the fields of the humanities, Germany did join the Union Académique Internationale in 1935 [96].

The Commission to study the founding of a new IMU in 1933–1936 was of course aware of the difficulties preventing German membership in the Union. In light of previous experience, establishing a new IMU without Germany was not a tempting option, even though the reason for Germany's absence would have been different from what it had been in the 1920s.

In the international arena, political developments were not auspicious. The events in 1933 caused damage to Germany's standing. Hitler's measures and Italy's invasion of Abyssinia added to political tensions, and so did the civil war in Spain, which soon assumed international dimensions. Politics pervaded science outside Germany as well. Mussolini had assumed the right to select new members of Italian academies, and he finally forced the fusion of the venerable Accademia Nazionale dei Lincei with his new Accademia d'Italia. Mathematicians from the USSR had attended the International Congresses in 1924, 1928, and 1932, and international mathematical conferences had taken place in Moscow in 1934 (differential geometry) and 1935 (topology). But thereafter, most contact between Soviet mathematicians and their foreign colleagues ended. All in all, there was ample reason to read Julia's remark that 1936 was even less favorable than 1935 as a reference to the deteriorating political situation.

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[1]The Minister was Dr. Bernhard Rust, an unemployed provincial schoolmaster who was a long-time follower of Hitler and *Obergruppenführer* in the paramilitary Nazi organization SA (*Sturmabteilung*). However, German science policy had many facets, in part a result of the personal interest in such policy taken by some powerful politicians, among them Göring and Goebbels. The Kartell of Academies was able to play a role until its dissolution in 1940.

The failure to recreate the IMU in 1936 in Oslo was final in the sense that the Congress set up no new commission to continue the study of a new Union. In spite of the gloomy political atmosphere, the desirability and importance of an international mathematical organization was discussed in Oslo. These feelings were buried for years by the events that followed, but after World War II they were soon rekindled.

3.4 The Oslo Congress in 1936

At the beginning of the twentieth century, the two leading countries in mathematics were Germany and France. Accordingly, German and French were the main mathematical languages. After the Second World War, the major language became English. The development that gradually led to English assuming a dominant position began in the 1930s. It was greatly intensified by the exodus of mathematicians from continental Europe to Britain and even more so to North America after Hitler's rise to power in Germany [97].

The 1936 Congress in Norway was much more Anglo-American than the previous two. The largest national group of mathematicians was from the United States, 86 of 487; the second largest, 48, from the United Kingdom. Yet the language of the Congress Proceedings was French. (In 1932 it had been German, in 1928 Italian.) The number of German participants was again sizable; besides those from Germany there were German mathematicians who had emigrated in 1933 and the years following. Total participation was smaller than it had been in Bologna and in Zurich. Politics interfered with mathematics. As related above, Italy did not take part in the Congress for political reasons, and shortly before the Congress opened, word came from Moscow that Soviet mathematicians were being prevented from coming to Oslo.

The Congress was held on 14–18 July 1936 at the University of Oslo. The great Norwegian mathematicians Niels Henrik Abel and Sophus Lie were duly remembered. At the opening ceremony, Carl Störmer was elected President of the Congress. The awarding of two gold medals, offered by J.C. Fields and accepted by the Zurich ICM-1932, was now for the first time an important feature of the International Congress. In Zurich these medals had still been nameless, but since Oslo they have been called the Fields Medals. In the absence of Severi, the Chairman of the Fields Medal Committee, Elie Cartan made public the decision of the Committee to award the first two Fields medals to Lars Ahlfors, from the University of Helsinki, Finland, and Jesse Douglas, from the Massachusetts Institute of Technology, USA. (A list of the Fields Medal winners and Committees in 1936–1994 is given in the Appendix, Section 9.)

Carathéodory presented the work of the winners. "Ahlfors (born in 1907) is one of the most splendid representatives of the famous Finnish school of function theory...." His teachers were Ernst Lindelöf, the founder of the Finnish school, and Rolf Nevanlinna, whose theories have influenced all the research of Ahlfors. In addition to the contributions to Nevanlinna theory, Ahlfors has done work on covering surfaces, which has opened a new chapter in analysis. It could be called "metric topology."

Jesse Douglas (born in 1897), after work in differential geometry and calculus of variations, became famous for his great papers on Plateau's problem. His striking progress in this classical field was largely based on new original ideas, which revealed intrinsic connections between the theories of minimal surfaces and conformal mappings.

In a ceremony attended by the King of Norway, Cartan then presented the Medals to Ahlfors and to Wiener, who represented Douglas. According to the Congress Proceedings, Douglas, although in Oslo, was too tired to be present at the opening session [93].

Fifty years later, at the opening of the 1986 ICM at Berkeley, Ahlfors said that when he arrived in Oslo, he did not know that the Medal had become a reality. He had not been told anything officially until he entered the room where the opening ceremony would take place, but he had been warned beforehand by somebody who had inadvertently congratulated him the day before. There was no tradition to go by and no protocol to follow [98].

For the next Fields Medal Committee, the Executive Committee of the Congress appointed Hardy (Chairman), P.S. Aleksandrov, Hecke, Julia, and Levi-Civita, with Lefschetz and Nevanlinna as alternates. Hardy declined, and he was replaced by Lefschetz. This Committee never had the opportunity of selecting Fields medalists. Since the war forced the postponement of the 1940 ICM by ten years, a new Fields Medal Committee was set up. None of the members appointed by the Oslo Congress served on this new Committee.

The Oslo Congress was told of a new form of activity, international conferences on specialized topics, which later were to develop as one of the main occupations of the new IMU. S. Lefschetz reported that an international topology conference had taken place in Moscow in September 1935 and that an invitation had been issued by W. Sierpinski to a topology conference in 1939 in Poland. It was agreed that the conference would meet in Warsaw at that time, but in anticipation of coming events, there was added the reservation "if circumstances permit."

In the closing session, the Congress applauded warmly the idea of sending telegrams to Hilbert, Picard, and Volterra.[2] L.P. Eisenhart invited the

[2]Hilbert was German, and Picard and Volterra had visibly represented the policy of barring Germany from international organizations. The discrepancies of the 1920s had been forgotten. This was further manifested by the Royal Swedish Academy of Sciences in 1939, when it announced the new Mittag-Leffler Prize. Even though Mittag-Leffler

mathematicians to the ICM in 1940: "The American Mathematical Society hereby extends to the International Congress of Mathematicians now in session in Oslo an invitation to hold the next congress in the United States of America, the place of meeting to be determined later by the Society" [93]. Eisenhart has the extraordinary record of having tendered an invitation to two different ICMs to be held in the United States of which neither took place. (In 1920 he had presented an invitation to the ICM-1924 in New York with L.E. Dickson; see Section 2.2.)

Soon the Americans decided to hold the Congress during 4–12 September, 1940, in Cambridge, Massachusetts, at Harvard University and the Massachusetts Institute of Technology. The American Mathematical Society, which was to manage the Congress, appointed an Organizing Committee with W.C. Graustein as Chairman. George D. Birkhoff was appointed President Designate—formally the Congress elects the President.

Preparations began, and they continued into 1939. Then World War II put an abrupt end to them. Germany attacked Poland on 1 September 1939, and France and Britain declared war on Germany two days later. The Congress organizers reacted immediately. At the Council of the American Mathematical Society on 6 September 1939, Graustein, speaking for the Organizing Committee, proposed suspension of activity, postponement of the Congress to a more favorable time, and the appointment of an Emergency Executive Committee to announce the postponement of the Congress and take the initiative for resumption of activity. These proposals were adopted, as were proposals aimed at conserving the contributions and pledges of funds for the Congress when it was rescheduled [99]. Ultimately, the Congress took place at Harvard University, but ten years later than originally planned.

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had been a fierce opponent of Picard (Section 2.1), the first Prizes were awarded to Hilbert and Picard.

The Oslo Congress had a special reason to express sympathy to Volterra. Having refused to take the obligatory oath of loyalty to Mussolini's regime, Volterra had been dismissed from his academic positions.

4

Foundation of the New IMU (1945–1951)

The outbreak of the Second World War (1939–1945) led to cessation of the activities of ICSU and its Unions. After the war, cooperation between the Western Allies and the Soviet Union proved short-lived. The Iron Curtain soon divided the world, and the Cold War began. With the gradual disintegration of the colonial powers, many new states were created. These developments had a bearing on the scientific world.

The United Nations (UN), a name that during the war had denoted the nations allied in opposition to the Axis Powers, became the new world organization whose primary objective was the maintenance of international peace and security. Its charter was drafted at the San Francisco Conference in April 1945, which was the first major international political conference in the Christian Era not dominated by Europe. A shift from Europe to North America had also taken place in science, not least in mathematics.

The United Nations Educational, Scientific, and Cultural Organization (UNESCO) was set up as a specialized agency of the UN. UNESCO soon expressed the wish that a suitable working arrangement be achieved with ICSU. Financial support from UNESCO through ICSU turned out to be of great importance for the new IMU, especially during its initial period.

The ideology of ICSU was to build cooperation in science based on unrestricted internationalism. This principle was followed when the IMU was formed again and the first postwar International Congress of Mathematicians was held. The times after World War II were definitely different from what they had been after World War I.

4.1 American Declaration of Universality

Immediately after the war, in the late summer of 1945, ICSU had started work for the resumption of activities. Its first postwar General Assembly met in London in July 1946. In his opening address, the Dutch President H.R. Kruyt crystallized the feelings prevailing in ICSU as follows: "We are inclined to keep politics as far from science as possible, for we know how much the International Research Council, the predecessor of ICSU, suffered after the First World War by not discriminating sufficiently in this respect; the development of international scientific cooperation then was prevented for at least ten years" [61].

The mathematical community, even though without a union and not associated with ICSU, felt in various countries that organized international cooperation should be reestablished. In 1947, the new Austrian journal *Nachrichten der Mathematischen Gesellschaft in Wien*, which a few years later was to become the official News Bulletin of the IMU for two decades, declared that the prime objective of mankind was to knit again the economic and, above all, cultural ties that the war had severed. In the same year, the French Mathematical Society advocated the re-creation of the IMU and published an ambitious working program for the planned Union. The French proposed that the foundation of the IMU should take place at the first postwar International Congress of Mathematicians.

However, in the 1940s it was up to American mathematicians to act. In retrospect, the mathematical community was lucky in having chosen in 1936 the United States to host the next International Congress. Thus the Americans had an international mandate to take charge of the work that aimed at reuniting the mathematicians of the world after the war. In those years, the United States was in the best position to do this.

The Americans took action immediately after the war had ended. The Emergency Executive Committee of the Congress, which had been established in September 1939, had kept in mind its responsibility "to take initiative for resumption of activity." When the discussions about organizing the ICM began in 1945, G.D. Birkhoff and Graustein had died, and Marston Morse had been elected the new Chairman of the Committee [100].

At the meeting of the Council of the American Mathematical Society in April 1946, the Emergency Executive Committee reported that "it was interested in the revival of plans for the Congress only if the Congress could be an open Congress to which all mathematicians would be invited, irrespective of national allegiance." The Council was in agreement with this declaration [101].

The meeting of the ICSU General Assembly three months later indicated that the announcement of the Emergency Executive Committee reflected what was generally felt in the scientific world at that time. Yet the explicit American "Declaration of Universality" was of importance for math-

ematics. At an early stage it set the tone for international mathematical cooperation after the Second World War.

The Emergency Executive Committee was of the opinion that it would be too soon to hold the Congress in 1948 but that 1950 should be explored as a date for holding an open Congress. In the Council meeting of April 1947, the invitation from Harvard University to hold the Congress in 1950 was accepted [102].

During the war, mathematicians in America had been harnessed in many ways to contribute to the war effort. One of the appointed committees, the War Policy Committee for Mathematics, continued its existence after the war; the word "war" was dropped from the name. The Policy Committee consisted of representatives of the American Mathematical Society, the Association for Symbolic Logic, the Institute of Mathematical Statistics, and the Mathematical Association of America. This Committee was assigned the authority to study the possibilities of forming again an International Mathematical Union.

The Chairman of the Policy Committee was Marshall H. Stone, President of the American Mathematical Society in 1943–1944, who in 1946 moved from Harvard to the University of Chicago. In his "forceful forties" (Fig. 4.1), he became the leader of the work that aimed at the foundation of the new Union. Throughout the preparatory period he kept this position, even though Morse later became Chairman of the Policy Committee and Stone was not even a member after 1949. In summer 1948, the Policy Committee set up a three-man subcommittee, consisting of Stone (Chairman), J.R. Kline, and Morse, to which it delegated the responsibility for all preparations concerning the planned Union. This mandate was kept in force until the constitutive meeting of the new Union in 1950.

A basic question was whether to plan a truly international Union, to which countries could join without political restrictions, or to proceed as had been done after World War I and exclude former enemies from membership. It was more complicated to determine the policy for the planned Union than for the Congress. The arrangements of the ICM were exclusively in American hands, and the international clientele consisted of individual mathematicians. In contrast, the re-creation of the Union required wide international agreement. In those years, memories of World War II, with all its suffering, atrocities, and injustices, were still fresh. Thus there was potential opposition to the creation of a universal union. Moreover, since the members of the IMU would be countries, the possibility was not excluded that political conditions beyond the control of mathematicians might play a role.

Stone's personal view was clear: He was for unrestricted internationalism. However, being aware of possible difficulties, he moved cautiously. He was first in contact with colleagues and science administrators in the U.S., among them ICSU's American President John A. Fleming. In a public speech in 1947, he ventilated his feelings about the old IMU: "The Interna-

FIGURE 4.1. Marshall H. Stone (1903–1989). American mathematician (functional analysis). Stone was in charge of the worldwide work in 1948–1950 that led to the foundation of the new IMU. He was the first President of the new IMU 1952–1954 and President of ICMI 1959–1962. Courtesy AMS, 1947/48.

tional Mathematical Union was formed some time after World War I, but I am unable to ascertain that any American mathematician had anything to do with it, and never understood why dues were paid. The impetus appears to have come from the French, perhaps with the chief aim of punishing the Germans, since they were adamant against German participation in the Congresses." He then presented a short (and not quite accurate) account of the history of the IMU and the Congresses in the 1920s and 1930s [103].

In the same speech, Stone clearly defined his, and the Policy Committee's, stand about universality: "In considering American adherence to a Union, it must be borne in mind that we want nothing to do with an arrangement which excludes Germans and Japanese as such." He then continued: "In this, I believe that more than ninety percent of the British mathematicians concur, and probably also the Dutch. We are fearful that the motive back of the great activity of the French toward the formation of

a Union is political, to promote the extension of French cultural domination over the satellite nations of Europe."[1]

Stone also pointed to the great importance of including the Russians in any international organization that might be set up. He complained of the inability of the outside world to communicate with Russian scientists. This barrier was of great concern for ICSU also. Secretary General F.J.M. Stratton wrote in 1947, "As to Russia... how are they to be brought in. With the exception of Astronomy and Chemistry they have joined none of the Unions, and it was a general complaint at Paris that letters to the USSR in general remain unanswered and in many cases are known not to have reached the addressees. We have decided on a direct letter to Stalin... and I am trying to arrange it but I am not hopeful of the results" [104].

The first idea to contact mathematicians outside the United States was to take advantage of the Assembly of UNESCO in Mexico City in November 1947. The Policy Committee, through the Council of the American Mathematical Society, asked ICSU to sponsor a meeting of mathematicians in connection with this UNESCO meeting, to discuss plans for the establishment of an International Mathematical Union [105]. In spite of positive reactions on the part of ICSU, financial support did not materialize, and the plan had to be abandoned. Instead, it was decided to try to hold such a meeting, called a "Union Conference," at the time of the International Congress in 1950. In retrospect, it was probably good to have had more time for the preparation of the conference.

4.2 Preparation of the IMU Statutes

At an early stage, the three-man subcommittee—Stone, Morse, and Kline—authorized by the U.S. Policy Committee to promote the formation of the IMU, took up the question of future International Congresses. Should they be carried on as in the past, that is, with one Congress accepting the invitation of a certain national group and the latter assuming the responsibility for all arrangements for the Congress? Or should the Congresses in the future be organized by the Union? The trio felt that the method used heretofore should be continued.

In July 1948, Stone outlined his plan of action to Morse and Kline. The three main questions to be settled were the admission of former enemy groups (from the American point of view), the location of the office of the Union, and the basis for assigning votes to and assessing dues against affiliated national groups. With regard to a constitutional convention, Stone suggested that preparations for it should be made by way of correspon-

[1]Stone did not specify what he meant by the "satellite nations of Europe" in this context.

dence. The time, place, duration, and preliminary organization of the convention should be specified. It should preferably be held in Princeton or New York, immediately before the 1950 Congress. The result of the work of the convention should be the adoption of the proposed statutes and the creation of a continuing Executive Committee that would receive memberships in the Union. The Union could come into being on the basis of the work of the convention and the voluntary membership of national groups without any further formalities. This was exactly the procedure that was to be applied until the Union was in existence.

In October 1948, the Policy Committee was ready to approach mathematicians outside the United States. Before the official invitation to the Union Conference was issued in May 1950, all correspondence was signed by Marshall H. Stone. He played a marked personal role in the preparatory arrangements that ultimately led to the formation of the IMU. In his letters he used the first person singular form usually without reference to the Policy Committee. On the other hand, he scrupulously emphasized his role as a coordinator.

From the beginning, Stone assumed a pragmatic way of handling the problems related to a possible IMU. The first circular letter, "Communication I," was brief. After presenting the Policy Committee and its role, he wrote that by 1950, conditions would favor a representative meeting of mathematical delegates to lay the foundations for an International Mathematical Union. He referred to the fact that the next ICM was then to be held in the United States and said that it would be natural to hold such a meeting just prior to the Congress but separately from it. If such a meeting should be desired, the Committee would act as host and take care of the necessary practical arrangements. The letter concluded with the important request that "a representative committee of mathematicians be designated in your country, if none has already been so designated, to enter into such preliminary discussions [106]."

The first copies of Stone's "Communication I" were mailed on 28 October 1948. The recipients formed a miscellaneous group that consisted of societies and individual mathematicians from Argentina, Brazil, Britain, Denmark, France, India, and Switzerland. This selection was still haphazard, but the mailing list was extended step by step so that by the summer of 1949 it comprised twenty-six countries, including the USSR and China.

In the meantime, Stone had sent out "Communication II"; the first copies were mailed on 21 February 1949 [107]. It was an explicit invitation to the recipients to join the work. Stone wrote, "The success of the proposed meeting will clearly depend upon our ability to organize the discussion in such a form that different points of view can be frankly discussed in an orderly, systematic way and thereby brought into harmony or resolved by dignified compromise. I wish to suggest that the groundwork for the meeting can most effectively be laid by preparing rough drafts of the Statutes and By-Laws of the proposed Union in advance of the meeting, so far as that can

be done by correspondence. The chief purpose of this communication is to ask your cooperation in preparing such drafts, with the help and advice of your mathematical colleagues." Stone pointed out that the proposed meeting could not of itself create an International Mathematical Union. The work done at the meeting should result in an agreement on the Statutes and By-Laws of the proposed Union, in the establishment of machinery for national or geographical groups to join the Union, and for the declaration of the effective existence of the Union when enough memberships had been received.

Stone made a practical proposal: "It is without doubt easiest to start work on the basis of a suitable model. A careful survey of the constitutions of existing international unions has led me to the conclusion that the most satisfactory model for us would be the Statutes and By-Laws of the International Union of Crystallography, copies of which are enclosed. I would like to suggest that you study this model carefully and send me a list of all the major changes, omissions, and additions which you and your colleagues may consider desirable for our purpose. I shall then try to collate all the suggestions received from all the recipients of this communication, and will report on the points of agreement or disagreement.... Whenever we appear to have reached agreement on one point or another under discussion, I will try to draft the corresponding sections of Statutes and By-Laws and circulate the results for criticism.... It should suffice to work out a rough draft accompanied by a clear indication of the points at which substantial agreement cannot be reached, leaving the discussion of such points to the debates of the meeting of delegates in 1950."

In addition to the Statutes and By-Laws of the International Union of Crystallography, Stone enclosed the text for the section "Objects of the Union," which he had written himself. Stone explained that he had been guided by the principle that the Union should have very broad powers but quite restricted obligations, thus conserving the greatest possible freedom of action. For example, the relation of the International Congresses to the proposed Union had been left loose and flexible.

The part of the Statutes defining the objects gave rise to a relatively small number of remarks. Not many changes were made before the section "Objects" assumed the form in which it was approved for the first Statutes of the IMU. This part of the Statutes has remained constant through the years. The only difference between the first Statutes and the Statutes of 1987, which are now valid, is that the word "Objects" has been changed to "Objectives." No reasons have been found to alter the object(ive)s, which are as follows:

1. to promote international cooperation in mathematics;

2. to support and assist the International Congress of Mathematicians and other international scientific meetings and conferences;

3. to encourage and support other international mathematical activities considered likely to contribute to the development of mathematical science in any of its aspects—pure, applied, or educational.

A list then followed of how the Union was "explicitly but not exclusively empowered in the pursuit of its objectives." The first of these was to join the International Council of Scientific Unions. The others were to organize international mathematical meetings, to engage in or support the publication and distribution of mathematical material, to advise and assist other international organizations engaged in mathematical activities, to promote the international exchange of mathematicians, and to publish and distribute information concerning the Union.

Stone's letter triggered an extensive dialogue between himself and several national committees for mathematics—or their counterparts. On the basis of the responses to his Communication II, Stone sent out a Draft of the Statutes and By-Laws in August 1949 [108]. By that time, fourteen countries had formed a National Committee for Mathematics, in agreement with the proposed Statutes. Stone thanked in particular the Committees of Denmark, France, India, and Italy for several helpful suggestions. Again, this Draft led to new suggestions; at this stage Great Britain was particularly active. With due regard to the comments, Stone wrote a Revised Draft and sent it out in March 1950 [109]. By that time, the number of National Committees had risen to twenty. For the Union Conference, Stone could still make a list of the comments made on the Revised Draft.

In his preparation of the Statutes and By-Laws, Stone did not conceal his own contribution. On the contrary, he found that since the labor of preparing the draft copies had been a personal one, its results were on that account to be all the more freely discussed and criticized. In fact, preparing the Statutes and By-Laws became joint work, where every proposal was carefully considered. A good number of changes were made, until the Statutes and By-Laws were eventually approved. To mention two concrete examples: the General Assembly was to meet every fourth year, instead of every two or three years; and there should be no representative of ICSU in the Executive Committee. The British suggested that "Secretary-General" of the original text be changed to "General Secretary." To achieve a compromise pleasing to all, the word "General" was dropped. That is why the Union has a Secretary.

The membership of a member country was to be in one of the five groups I–V. The division into groups has a twofold significance. First, the number of votes of a member country is equal to the number of the group to which it belongs. Second, each member country shall pay an annual subscription in accordance with the group in which it belongs as follows: In groups I, II, and III, the number of unit contributions is 1, 2, and 3, respectively. In group IV it is 5, and in group V it is 8. This was exactly the formula of the International Research Council and of the old IMU adopted in 1919.

At that time, the assignment of a member country to a group depended on its population. Now the group was to be determined by the Union, after the country had announced its wish. Not surprisingly, this delicate question gave rise to numerous comments. Similar difficulties were encountered when this part of the Statutes was slightly changed by the General Assembly in 1974.

Some minor points generated so much correspondence that with today's experience of the Union, it could be seen as an exaggerated use of energy. In contrast, the time devoted to finding a suitable formulation for the section "Membership" was not wasted. The beginning looked easy: "A country adheres to the Union through a national adhering organization.... In each case, the national adhering organization shall form a national committee for mathematics...." In August 1949 Stone wrote, "There is a widespread desire to make the new Union a truly universal one. At the same time the concepts of sovereignty and nationality now cover such a broad spectrum of political arrangements that the correct choice of language to express the formulas which will assist us in achieving the object of universality is not at all easy." The formulation finally accepted was as follows: "The term 'country' is to be understood as including diplomatic protectorates and any territory in which independent scientific activity in mathematics has been developed, and in general shall be so construed as to secure the broadest and most effective participation of mathematicians in the scientific work of the Union."

In formulating this paragraph, mathematicians could resort to other examples. The question of defining "country" had been discussed already at the IRC and at the founding of ICSU in 1931. But after World War II the problem became significant, and the formulations adopted by ICSU and its Unions were more or less the same. The broad definition proved farsighted, serving the IMU to good effect when "countries" not recognized diplomatically everywhere but fulfilling the condition of the Statutes applied for admittance to the Union.

The proposed sentence "Membership is open to all countries" was deleted at an early stage. However, this was more or less what was meant during the first years of the Union. Without a change in the Statutes, the membership clause has later been interpreted differently. Only countries with enough mathematical research activity are admitted to the IMU. This is assessed with the help of *Mathematical Reviews* or other reviewing journals. It has happened a few times that the Executive Committee has felt itself unable to recommend admission.

The location of the office of the Union, which Stone had regarded as one of the main questions, was settled without difficulty. It was agreed that it should coincide with the site of the Secretary's normal residence.

In choosing the addressees of his communications, Stone apparently took a purely practical view. An omission caused some acid correspondence: Stone had overlooked his Canadian colleagues! This was corrected, but for

a while the Canadian attitude to the planned Union was reserved. In December 1949, the Secretary of the Canadian Mathematical Congress wrote, "The question of a Canadian committee will be discussed at the next meeting.... It is, however, not possible for us to discuss the matter intelligently without some idea of the need of such a union. So far as I remember, one of the principal objects sought in the establishment of the old union seemed to be to keep the Germans from having a part in international congresses, and if this was the case it is not a very good precedent for the formation of a new union" [110]. Canada, which later contributed greatly to the cause of the Union, did not take part in the 1950 Union Conference and the first General Assembly in 1952.

Stone had intentionally postponed tackling the question of whether or when to invite the former Axis countries to set up national committees and participate in the discussions about the new IMU. Germany and Japan were, of course, among the problem countries; in addition, Stone had singled out Austria. Regarding Austria and Japan, he wished first to hear the opinion of some selected National Committees. They were all in favor of membership. Stone felt that the problem of Austria was hereby solved.

After this, Stone wrote a letter to General Douglas MacArthur, the Supreme Commander of Allied Powers in Japan, asking for permission to initiate negotiations with Japanese mathematicians. The answer from General MacArthur was completely positive, and the reaction from Washington was in the same direction: "It is the view of this Government that the initiation and renewal of contacts between the Japanese people and the outside world will help to foster in Japan democratic and peaceful attitudes. It is apparent that the establishment of contact between your group and Japanese mathematicians is a step in this direction" [111]. This was all Stone needed. In early 1950, Austria and Japan had each set up a national committee for mathematics.

The case of Germany was more difficult. First of all, there were the memories from the time after World War I. Besides, the country was divided into four occupational zones, of which the Soviet zone was becoming more and more isolated from the three Western zones. In 1949, two states were formed, called at the time West and East Germany. As Stone was in no hurry to act, the first move came from the German Mathematical Society, which represented mathematicians in both West and East Germany. In November 1949, E. Kamke, President of the Society, wrote to Stone [112]:

> *Wie ich höre, sind Sie mit der Vorbereitung einer Internationalen Mathematischen Union beschäftigt. Da ich annehme, daß Sie auch ein Interesse an der Beteiligung deutscher Mathematiker haben, möchte ich Ihnen hiermit anzeigen, daß die Deutsche Mathematiker-Vereinigung seit einiger Jahren wieder besteht.... Ich würde mich daher sehr freuen, wenn wir in einen Gedankenaustausch über Ihren Plan eintreten könnten.*

> (I have heard that you are working on preparations for an International Mathematical Union. Assuming that you are also interested in the participation of German mathematicians, I would like to inform you that for a few years, the German Mathematical Society has again been in existence.... I would be very glad, therefore, if we could initiate an exchange of ideas about your plan.)

Stone felt that granting a green light to Germany required wide international agreement. Therefore, he replied to Kamke, "It is to be hoped that there will prove to be no barriers to the opening of such a correspondence in the comparatively near future; but for the present my reply to your letter can be nothing more substantial than a plea for patience while the unavoidable preliminary steps are being taken" [113].

Prompted by Kamke's letter, Stone sought international opinion about Germany. His letter was sent to all national committees then in existence (including now Japan); the deadline for answers was set for 1 February 1950. The result was unambiguous: No country was against inviting Germany. The positive outcome was announced in Stone's letter of 2 February 1950 to Kamke [114]. Germany responded quickly to Stone's invitation to appoint a national committee.

Most of the answers to Stone's inquiry about Germany were brief statements in favor of admitting Germany. Some added that in the Union, countries must not be discriminated against for political reasons. The French view was in an informal letter from M. Brelot to Stone [115]. Brelot wrote that some of the aged mathematicians like Borel and Montel were not enthusiastic about the idea of establishing contacts with the Germans so rapidly, but they refrained from any objections, because they did not want to undermine the rapprochement advocated by the younger colleagues. Brelot's summary was, *"acceptation quasi-générale."*

Much later, in 1976, Stone wrote, "It was by no means clear to anyone that the terrible bitterness left by the war would permit the establishment of a union open to all nations. Fortunately, there were mathematicians like Mandelbrojt in France and the United States, and Kuratowski in Poland who might have expressed bitter opposition but who instead took the lead in publicly favoring the admission of Germany" [116].

Nothing now prevented the establishment of a universal Union without any political restrictions. However, during all of Stone's correspondence, no response had been received from the USSR. The other Socialist countries of Europe also did not react positively to the Union, with the exception of Yugoslavia. The Iron Curtain had been drawn in Europe. After Stalin's death, in 1953, the political atmosphere began to change. Having taken part in the 1954 International Congress, the Soviet Union and other Socialist countries of Europe joined the IMU before the end of the 1950s (Section 6.1). Stone is reported to have said, "If we do a good job of the Union, they

[mathematicians from the USSR and other Eastern European countries] will walk in. If we do not do a good job, the Union deserves to perish" [117].

4.3 The Rebirth of the IMU

In December 1949, the Policy Committee made the formal decision that the planned Union Conference would be held in New York, at Columbia University. A few days later, the Policy Committee was officially informed that UNESCO had granted $10,000 to be used for travel costs of the participants. (The application had been made in the name of the American Mathematical Society and the Policy Committee.) For ensuring good attendance, this subvention was of essential importance. In 1950, the scientific world outside North America did not have extensive funds for travel.

The invitations to the Conference, to be held during 27–29 August 1950, were sent in May 1950 in the name of the Policy Committee by its Chairman Morse and Secretary Kline. Invited were the National Committees then in existence and only these. Each Committee was requested to send at least one and no more than three delegates. Thanks to the UNESCO grant, the travel costs of one delegate per country could be defrayed by the hosts. The delegates were required to pay their own expenses for room and board in the Columbia dormitories. These accommodations would be furnished "at a modest rate" [118].

The organizers first planned to allow at the Conference the use of four languages, English, French, German, and Italian. When the costs for interpreters turned out to be too high, German and Italian were dropped.

Work on the Statutes and By-Laws had progressed well. Yet Stone, Morse, and Kline felt that a Steering Committee was needed for preparing and running the Union Conference. They selected five countries—Denmark, France, Great Britain, Italy and Poland—and asked their National Committees each to appoint a representative. The Steering Committee so formed started its work under Stone's chairmanship in the spring of 1950. It decided to recommend to the Conference that the voting strengths of the participating countries would be as follows: Three votes for USA, France, Great Britain, Germany, Italy, and Japan; two votes for Austria, Belgium, Denmark, India, the Netherlands, Poland, Sweden, and Switzerland; and one vote each for all the others [119].

The Conference was opened by Morse. Kline was the Secretary, and the third U.S. delegate was, of course, Stone. Of the participants, five were future Presidents of the IMU: Stone, Nevanlinna, de Rham, H. Cartan, and Chandrasekharan. The minutes contain some errors concerning actual attendance. The correct list is as in the "Enabling Resolution" (see below), which was printed and circulated by the Royal Danish Academy of Sciences in December 1950 [120].

The careful preparation of the Statutes and By-Laws bore fruit: Consensus about them was reached, and a number of other important decisions were made towards the foundation of the Union. They were all condensed in the published paper "Enabling Resolution." It is unique among the documents of the Union in its judicial dignity. Quotations from the Enabling Resolution describe the essentials of the meeting [120]:

> Whereas the delegates of national committees representing the mathematicians of twenty-two countries, to wit, Argentina, Austria, Belgium, Brazil, Cuba, Denmark, Finland, France, Germany, Great Britain, Greece, India, Italy, Japan, Jugoslavia, the Netherlands, Norway, Sweden, Switzerland, Turkey, the United States of North America, and Uruguay, have met in convention in the City of New York from August 27 to August 29, 1950; and
>
> whereas the said convention has discussed and duly adopted the Statutes and By-Laws indispensable for the inauguration of a new International Mathematical Union; and
>
> whereas the said convention desires further to provide for the prompt and orderly creation of such a new union in accordance with the Statutes and By-Laws which it has framed, and also for the speedy convocation of the first General Assembly of the new union;
>
> now therefore be it resolved that the said convention form a committee, to be known as the Interim Committee for the International Mathematical Union and to be designated hereinafter simply as the Interim Committee, with composition, functions and responsibilities as follows:
>
> 1. the Interim Committee shall be composed of members of the Steering Committee, later known alternatively as the Executive Committee, of the said convention, together with one additional member designated by the National Committee for India as its representative;
>
> 2. the Interim Committee shall act in all respects as the Executive Committee of the said convention and as its agent in the execution of its directions until such time as the International Mathematical Union shall have been declared in existence as hereinafter provided; and thereafter the said Interim Committee shall act in all respects as the Executive Committee of the said Union in harmony with the Statutes and By-Laws, until such time as the first General Assembly of the Union shall have convened...;
>
> 3. the Interim Committee shall, in particular, seek and receive adherences of the Union and shall accept those which it deems

> to be in harmony with the principles embodied... [in] the Statutes;
>
> 4. the Interim Committee shall declare the International Mathematical Union to be in existence as soon as it shall have received and accepted the adherences of ten countries and then, within a reasonable period of time thereafter, it shall convene the first General Assembly of the Union at such time and at such place as it may determine;
>
> 5. the Interim Committee shall determine its own internal organization...;
>
> and be it further resolved that the said convention shall publish this resolution by copies certified by the signature of its secretary, Professor J.R. Kline....

The Interim Committee consisted of E. Bompiani (Italy), M. Brelot (France), W.V.D. Hodge (Great Britain), B. Jessen (Denmark), K. Kuratowski (Poland), M.H. Stone (USA), and D.D. Kosambi (India), who was appointed a couple of months later. By point 5 above, the Committee was free to decide about its internal organization. It elected Börge Jessen as Secretary (Fig. 4.2). In that capacity Jessen was in charge of the affairs of the Union until its first General Assembly.

Shortly after the New York Convention, Jessen initiated correspondence with representatives of ICSU and UNESCO. Assuring ICSU that the IMU would seek membership at the earliest possible occasion, he wished to secure a UNESCO contribution through ICSU, even before the Union was formally in existence [121]. A preliminary promise of UNESCO support was in fact received at an early stage; it facilitated subsequent planning and launching of the Union's activities.

In December 1950, the Statutes and By-Laws of the Union, which had been accepted at the constitutive meeting in New York, had received their final touch. Jessen approached potential members of the Union with a mailing containing three documents: an "Invitation to adhere to the International Mathematical Union," the Statutes and By-Laws of the IMU, and the Enabling Resolution of the New York convention. All correspondence with the Interim Committee was requested to be addressed to its Secretary, the Royal Danish Academy of Sciences, Copenhagen. Thus the Danish Academy was the first headquarters of the new IMU.

By point 4 of the Enabling Resolution, the Union was officially established as soon as ten countries had joined. On 10 September 1951, Jessen could announce to the National Adhering Organizations that this goal had been reached [122]. The IMU was officially in existence again. The 1932 decision could have been interpreted as a suspension of the activities of the IMU. However, the new Union preferred to forget its past. During the preparation of the new Statutes, no mention was ever made of the Statutes

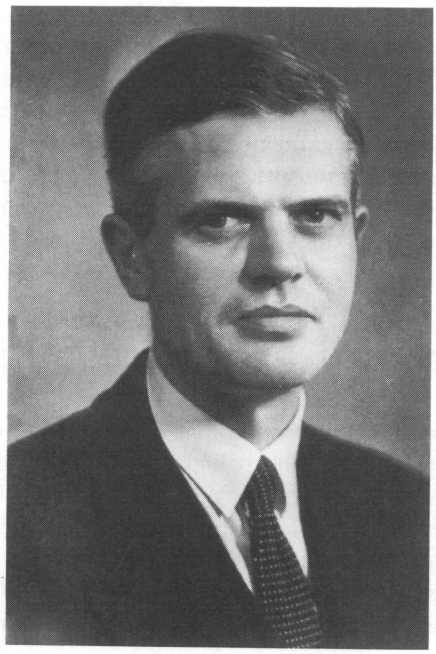

FIGURE 4.2. Börge Jessen (1907–1993). A representative of the Danish school of analysis. Secretary of the Interim Executive Committee of the IMU 1950–1952, he declared in September 1951 the official founding of the Union, with its first domicile in Copenhagen. Courtesy the Royal Danish Academy of Sciences and Letters.

of the old IMU, even though there were many similarities. The relation between the two IMUs will be briefly discussed in Section 5.3.

The first ten member countries, in alphabetic order, were Austria, Denmark, France, Germany, Great Britain, Greece, Italy, Japan, the Netherlands, and Norway. It is to be noted that the prime initiator, the USA, was not on this list. Fulfilling the formalities took its time, but in December 1951, Jessen announced that five more countries—Australia, Canada, Finland, Peru, and the USA—had joined the IMU [123].

It had been planned to hold the first General Assembly during 1951, but it soon became clear that membership was growing more slowly than had been estimated and that the original timetable could therefore not be adhered to. However, the postponement was not long: Simultaneously with the declaration of the formal existence of the IMU in September 1951, Jessen made the important announcement that the first General Assembly of the International Mathematical Union would be held in Rome on 6–8 March 1952. The agenda of the Assembly was sent to the members with Jessen's letter of December 1951.

There has been some confusion over whether the Union came again into being in 1950, 1951, or 1952. All these years are important milestones in the history of the IMU. At the 1950 Constitutive Convention, the new IMU was created *de facto*. By the statutes adopted there, it came into existence *de jure* in 1951 when ten countries had become members. The General Assembly inaugurated the activities of the new Union in 1952 and elected its first President, the Executive Committee, and various Commissions. In 1952 the IMU was also readmitted to ICSU.

4.4 ICM-1950 at Harvard: American Tour de Force

The ideology of openness became explicit in connection with the first post-war International Congress. The principle of making the Congress truly international determined its timing. While it was desirable to organize the Congress soon after the war, the circumstances had to be such that mathematicians could be invited irrespective of national or geographic origin. Thus it was decided to hold the Congress in the year 1950. This decision also determined the timetable of the preparations aiming at the founding of the new IMU.

Before the Congress, some political events were acutely felt in the United States. The end of the atomic monopoly in 1949, which shattered the military balance of power, was seen as a result of Soviet espionage. At about the same time, the Communist conquest of China was completed. The Korean War started in June 1950. Anti-Communism increased in the United States.

Yet organizers of the Congress ignored the political developments and continued to emphasize that all mathematicians of the world would be welcome. A special effort was made to secure a visa for every mathematician who planned to attend the Congress. In spite of the difficulties, the organizers, with the assistance of the U.S. State Department, succeeded almost without exception.

The Congress was held from 30 August to 6 September 1950, in Cambridge, Massachusetts, at Harvard University. After the death of George D. Birkhoff, Oswald Veblen was elected President Designate—the Congress then elected him President. The Organizing Committee had been set up in 1948 with Garrett Birkhoff, the son of G.D. Birkhoff, as Chairman and J.R. Kline as Secretary.

The 1950 Congress, with more than 2,300 participants, was more than twice the size of the largest ICM before it. Of the 1,700 ordinary members, eighty percent were from the United States. This was impressive proof of the rapidly increased strength of American mathematics. In his opening address, President Veblen said that in 1936 the colonial period of American mathematics was ending. At the same time, mathematics had attained

a small but growing amount of recognition from the rest of the American community—enough to encourage the United States to invite the mathematicians of the world to a congress in 1940. He then continued:

> Now, fourteen years have elapsed since the invitation was issued, and we are approaching the end of another epoch. I mean the period during which North America has absorbed so many powerful mathematicians from all over the world that the indigenous traditions and tendencies of mathematical thought have been radically changed and enriched. These American gains have seemed to be at the cost of great losses to European mathematics. But there are so many signs of vitality in Europe that it is now possible to hope that the losses will be only temporary while the American gains will be permanent.

The number of mathematicians from outside the United States and Canada, 290 out of a total of 1,700, did not meet expectations. In spite of subventions from UNESCO and American sources, travel costs alone were prohibitive for many mathematicians to come to the United States. Moreover, there were no participants from the Soviet Union or other Socialist countries. To quote the Congress secretary Kline: "Mathematicians from behind the Iron Curtain were uniformly prevented from attending the Congress by their own governments, which generally refused to issue passports to them for the trip to the Congress. Their non-attendance was not due to any action of the United States Government" [102].

Politics was again interfering with mathematical activities. However, compared to the situation after the First World War, there was the essential difference that this time the mathematicians themselves did their best to promote worldwide collaboration. The following cablegram arrived just before the opening of the Congress from the President of the Soviet Academy of Sciences: "USSR Academy of Sciences appreciates receiving kind invitation for Soviet scientist take part in International Congress of Mathematicians to be held in Cambridge. Soviet mathematicians being very much occupied with their regular work unable attend congress. Hope that impending congress will be significant event in mathematical science. Wish success in congress activities." (signed) S. Vavilov. The friendly tone of this message, which was read at the opening of the Congress, gave hope for future cooperation. This partly materialized at the next ICM.

In the fall of 1948, Veblen, then the nominee for the presidency of the 1950 Congress, together with the Chairman of the Organizing Committee Birkhoff and the Secretary of the Congress Kline, appointed the Committee to select the two recipients of the Fields Medals. (For the composition of the Fields Medal Committees, see the Appendix, Section 9.)

The Committee decided to award the Fields Medals to Laurent Schwartz, of the University of Nancy, France, and Atle Selberg, of the Institute for

Advanced Study, Princeton, who had moved to the United States a few years earlier from his native Norway. At the opening session of the Congress, Harald Bohr, the Chairman of the Committee, gave a survey of the work of Schwartz on the theory of distributions and of the work of Selberg on the Riemann zeta function and the elementary proof of the prime number theorem. In his address, Bohr explained the underlying philosophy of the work of the Committee: "The members were, unanimously, of the opinion that the medals, as in the occasion of the first medals in Oslo, should be given to two really young mathematicians, without exactly specifying, however, the notion of being young." In 1950, the age limit forty had not yet been explicitly taken into consideration, even though both recipients happened to be under forty, as they had also been in Oslo.

At the closing session of the Congress, Stone gave a report on the Union Conference held in New York City for the purpose of considering the formation of an International Mathematical Union (see Section 4.3). The invitation of J.G. van der Corput to hold the 1954 International Congress of Mathematicians in the Netherlands was accepted unanimously [102].

5

The IMU Takes Shape (1952–1954)

The Statutes and By-Laws provide the framework for the activities of the IMU. The important task of the first General Assembly, in Rome in March 1952, was to find forms for the implementation of the objectives of the Union and to elect the Executive Committee and Commissions to execute the decisions during the period 1952–1954. Today we know that the framework has remained almost constant. In contrast, the contents have undergone considerable developments.

In the years to come, the IMU was to play an important role as a promoter of mathematical cooperation between East and West. Later, advancing the cooperation between North and South also grew increasingly important. For the first General Assembly these lines were not yet visible. The Soviet Union and most of the other Socialist countries had not joined the IMU, and the time was not yet ripe for the Union to devote attention to the promotion of mathematics in the Third World.

Mathematical meetings were to become the most important form of the Union's activities. The role of the IMU in the International Congresses of Mathematicians, which has largely dominated the later work of the IMU, was recognized in Rome. However, the resolution "to assist the organizers of the 1954 Congress in all possible ways" was too vague to be of real significance. Mathematical conferences on specialized topics were not mentioned in the minutes of the first Assembly, but they had been discussed by the Interim Executive Committee already before the Union was even formally in existence. As soon as financial support from UNESCO through ICSU was assured, such conferences were introduced, and they quickly rose to im-

FIGURE 5.1. Villa Farnesina, Salone delle Prospettive, Rome, venue of the first General Assembly of the new IMU in 1952. The room may then have been less resplendent than in the picture, which was taken after the 1976–1983 restoration of the paintings to their original condition. Courtesy Accademia Nazionale dei Lincei.

portance. Formal rules for their organization were accepted by the second General Assembly in 1954.

In Rome, the International Commission on Mathematical Instruction (ICMI) became attached to the IMU, and its position was clarified in 1954. All in all, the IMU made a good start during the initial period 1952–1954 comprising the first two General Assemblies.

5.1 The First General Assembly in Rome in 1952

In January 1952, following Jessen's invitation, a secretariat was established in Rome for the first General Assembly of the new IMU. Local arrangements were in the hands of Enrico Bompiani (who was to be elected the first Secretary of the new Union). The Assembly convened during 6–8 March 1952. The venue in the Eternal City was impressive—the richly decorated Renaissance Villa Farnesina from the early 1500s (Fig. 5.1) [124]. Since

1944 it had belonged to the Accademia Nazionale dei Lincei, under whose auspices the meeting was held.[1]

Of the eighteen member countries of the IMU, sixteen had delegates present in Rome. UNESCO had granted $3,000 for the travel and subsistence expenses of the participants. As in the 1950 meeting in New York, the contribution was put to good use. By the rules of ICSU, "air travel was permitted when it was necessary to save time."

At the opening of the Assembly, the Union did not yet have a President. For reasons of neutral balance, a great number of chairmen served during the various sessions. Following his election as President of the Union, M.H. Stone took the chair. The meeting was bilingual, and interpreters translated between English and French, the languages of the Union.

However, at an important point symmetry was broken. Only the English text of the Statutes was adopted. A French translation was provided after the meeting.

By the official record of the Assembly, it was agreed that the procedure at the meetings of the General Assembly should be based on UNESCO's rules. This was printed in the minutes, but not having been mentioned at the meeting, the remark caused some correspondence, as explanations were required. That decision has apparently fallen into oblivion. The IMU is a markedly informal international organization.

Jessen read the report of the Interim Committee appointed in 1950 by the New York convention. In accordance with the Enabling Resolution (quoted in Section 4.3), he recalled that the Union had been declared to be in existence in September 1951, since at that time ten countries had already joined. He then presented the list of the eighteen countries that were members when the meeting opened:[2]

Group I: Australia, Austria, Cuba, Finland, Greece, Norway, Peru

Group II: Canada, Denmark, the Netherlands, Switzerland

Group III: Belgium

Group IV: France, Germany, Italy, Japan

Group V: Great Britain, USA

Except for Canada and Cuba, each of these countries had delegates in Rome (Fig. 5.2). During the Assembly, Argentina (Group I) and Pakistan, Spain, and Yugoslavia (Group II) were admitted as members of the Union. The delegates of Spain and Yugoslavia then participated in the meeting, as

[1]The venerable Accademia Nazionale dei Lincei had been restored after the fall of Mussolini's regime in 1943 (cf. Section 3.3).

[2]For the meaning of the Groups, see p. 80 and the Appendix, Section 1.

INTERNATIONAL MATHEMATICAL UNION

Record of the First General Assembly held on 6-8 March 1952 in Rome in the Palazzo Farnesina by invitation of the Accademia Nazionale dei Lincei.

Present:

A. DELEGATES.

AUSTRALIA	Dr. C. A. Hurst
AUSTRIA	Professor R. Inzinger. - Professor W. Gröbner (alternate).
BELGIUM	Professors L. Godeaux, Fl. Bureau, F. Simonart.
DENMARK	Professors N. E. Nørlund, B. Jessen.
FINLAND	Professor J. Nielsen.
FRANCE	Professors A. Denjoy, H. Cartan, M. Brelot, J. Pérès.
GERMANY	Professors E. Kamke, K. Knopp, H. L. Schmid, K. Strubecker.
GREECE	Professor Ph. Vassiliou. - Professor C. Papaïoannou (alternate)
GREAT BRITAIN	Professors W. V. D. Hodge, G. Temple.
ITALY	Professors E. Bompiani, G. Sansone, A. Terracini, B. Segre. - Professors A. Signorini, F. Conforto, C. Miranda, A. Tonolo (alternates).
JAPAN	Professor K. Kunugi.
NETHERLANDS	Professors H. D. Kloosterman, J. F. Koksma.
NORWAY	Professor Th. Skolem.
PERÚ	Professor M. Picone.
SWITZERLAND	Professors F. Fiala, A. Pfluger.
UNITED STATES OF AMERICA	Professors M. H. Stone, J. R. Kline, J. T. Whyburn, E. Hille, S. MacLane.

In addition, after minute (6):

SPAIN	Professor T. R. Bachiller.
YUGOSLAVIA	Professor D. Kurepa.

B. OBSERVERS.

POLAND	For the Panstwowy Instytut Matematyczny: Professors K. Kuratowski, S. Turski.
PORTUGAL	For the Junta de Investigaçao Matematica: Professor J. S. e Silva.

C. OTHER PARTICIPANTS.

UNITED NATIONS EDUCATIONAL, SCIENTIFIC AND CULTURAL ORGANIZATION	(UNESCO): Professor R. Berker of the Department of Natural Sciences.
INTERNATIONAL COUNCIL OF SCIENTIFIC UNIONS	(ICSU): Dr. R. Fraser of the Liaison Office (ICSU-UNESCO)

FIGURE 5.2. IMU First General Assembly 1952. The first page of the record of the meeting.

well as representatives of UNESCO and ICSU and observers from Poland and Portugal [125].

Political developments in the world were reflected in the membership. Of the twenty-two member countries in 1952, fourteen had been members of the Union in 1932. Eight new members replaced the nine old ones that had not joined. However, already in 1958, the members of 1932 except for two had become members of the new Union. (Cf. the remarks at the beginning of Chapter 6 and the membership lists in the Appendix, Section 1.)

In the historic Villa Farnesina the delegates were to breathe life into the Union. The Statutes constituted the framework but allowed much leeway for the Union's activities. In fact, the old Union, which had been a failure, had had statutes very similar to those of the new IMU. In Rome no reference was made to the prewar General Assemblies. It was rather the tradition stemming from the first International Congress of Mathematicians in 1897 in Zurich that guided many discussions. The decisions on how and in what concrete ways the IMU should implement its broadly defined objectives had many similarities to those recorded in 1897.

The Zurich Congress had resolved that for studying questions of an international nature, each Congress might appoint permanent commissions whose mandate was to last till the next Congress. This working method had been kept in mind: By the approved By-Laws, the General Assembly may from time to time establish Commissions, which "may co-opt additional members and shall generally have full freedom in arranging their own internal structure." The President is an ex officio member of all Commissions of the Union. (This stipulation was later forgotten; see Section 11.2.) The Rome Assembly set up six Commissions, and these were requested to report to the 1954 General Assembly.

In further resemblance to the 1897 Congress, the majority of the projects launched in Rome fell under the heading "bibliography." Four of the appointed six Commissions were to work for such purposes. In this field, implementation of ideas often requires funds and a substantial work force. That is why the initiatives taken in 1897 had led nowhere, and the 1952 projects did not thrive much better. However, there was a notable exception.

In 1897 the idea had been brought forth to achieve an address book of mathematicians throughout the world. The same suggestion was made in Rome. A Commission was set up and given the task to study the possibility of creating a directory or index of mathematicians. (After much toiling and narrowly escaping total failure, the problems were solved, and the first *World Directory of Mathematicians* (WDM) appeared in 1958. An account of the WDM, from the beginning until the 1990s, is presented in Section 6.3.)

The other bibliographical Commissions did not have success in their work. One Commission was to report on methods of facilitating and making less expensive the dissemination of mathematical knowledge through

various forms of publication. Another was to study different aspects of the problem of abstracting and reviewing mathematical papers by consulting with the various organizations now engaged in this work, and in particular by seeking methods of promoting further cooperation between these organizations. A third Commission was to consider the possibility of preparing a directory of mathematical symbols with definitions in five languages (English, French, German, Italian, and Russian).

The correspondence related to these Commissions reveals the difficult conditions under which they worked. Lack of funds prevented the Commission members from meeting. The freedom to arrange their own internal structure could have been better utilized if preparatory meetings had been held in Rome, when many of the members were present; but there is no record that such meetings took place. In many cases no one took the initiative, with the result that there was no responsible leadership and no working plan. The Commission to study abstracting and reviewing mathematical papers (a question that had attracted the IMU 1920 General Assembly as well) exchanged ideas about amalgamating *Mathematical Reviews* with the *Zentralblatt für Mathematik und ihre Grenzgebiete.*[3] With not enough positive interest on the part of the journals, this goal proved to be unrealistic [126].

Secretary Bompiani did his best to supervise and stimulate the work of the Commissions by writing a great number of letters to the members. The answers he received—if there was any response at all—were mostly vague and evasive and spoke of problems rather than of results. A letter of October 1953 to Bompiani from Henri Cartan, who was believed to be the chairman and convener of the Commission for mathematical symbols, is illustrative in its frankness: "As you perhaps know, this Commission has never met; it has not elected a chairman nor a secretary. I must say that I was designated a member of this Commission at the time of the Rome Assembly without my knowledge. Nevertheless, I would have taken part in the work had not our President, M. Stone, let me know that he did not consider urgent the discussions about mathematical symbols. Thus I can say now, without waiting until January, that our Commission has not done anything" [127].

The Rome Assembly agreed that "the Executive Committee should negotiate with the *Österreichische Mathematische Gesellschaft* (Austrian Mathematical Society) a contract for the publication of an international mathematical news bulletin continuing in a way suitable to the needs of the Union the work already undertaken by the ÖMG." The contract was concluded, and IMU news appeared for many years in the Austrian *Internationale*

[3]The first issue of *Zentralblatt für Mathematik* appeared in 1931, that of *Mathematical Reviews* in 1940. The old *Jahrbuch über die Fortschritte der Mathematik* ceased to exist in 1944.

Mathematische Nachrichten (the English name *International Mathematical News* was also used) under the title "Bulletin of the International Mathematical Union" [125]. In 1971, the Union began to publish its own *IMU Bulletin*, which records the main events of the Union. Reproaches are often heard that the National Committees for Mathematics do not make enough effort to distribute the Bulletin in their respective countries.

A Commission was appointed to study methods of facilitating the exchange of mathematicians, both professors and students, among nations. This Commission on Exchange was in existence until 1979. It was then replaced by the Commission on Development and Exchange (CDE), with the main objective of promoting mathematics in developing countries. As long as the emphasis was just on organizing the exchange of mathematicians, the results were disappointing, in spite of competent management of the Commission. A world organization was not much needed to steer and coordinate such exchange, which grew rapidly anyhow and was largely carried on through individual contacts.

In Sections 1.3 and 3.2 brief accounts were given about the Commission on the Teaching of Mathematics—how it was established at the International Congress of Mathematicians in Rome in 1908 and how, having been suspended in 1920, it was set up again in 1928. As it was connected with the International Congresses and not with the Union, it continued its existence in the 1930s in spite of the dissolution of the IMU in 1932. At the Harvard Congress, the mandate of the Commission was not discussed. Now the IMU Interim Committee presented to the General Assembly a letter from H. Fehr, Secretary General of the Commission, suggesting that the work of the Commission should be continued by the Union and offering the resignation of the present Commission.[4]

The Assembly agreed that the Commission should be attached to the Union and accepted the resignation of the present members, expressing heartfelt thanks for the important work that the Commission had accomplished. The offer from Fehr to place himself at the disposal of the new Commission was also accepted. In the beginning there was administrative friction, because not enough attention had been paid in Rome to regulating the relations of the Commission with the IMU, as will be related in Section 5.4.

Computers were not discussed in 1897, but in Rome they were. In 1951 UNESCO had announced a plan to create an International Computation Center. Without the intermediary of ICSU, UNESCO contacted the IMU, which was highly interested in the project. It was even suggested (but not sufficiently supported) that this interest be explicitly mentioned in the

[4]It is questionable whether the old Commission was formally in existence in 1952, having received its mandate in 1936 only until the next International Congress.

Statutes of the Union. In Rome, M. Brelot reported on the decisions taken so far on the creation of the Center.

During the following years the IMU became involved in extensive correspondence about the Computation Center. The initial enthusiasm of creating a counterpart of what CERN in Geneva was for high-energy physics waned rapidly, but the plan was kept alive in spite of only limited interest from the member countries of UNESCO. Impressive phraseology was employed, but the IMU liaisons, first Ch. Blanc, from Lausanne, and then R. Courant, from New York, were realistic in their reports. As late as 1959, Courant wrote to the IMU that the preparatory efforts had not yet resulted in concrete realistic plans. The Provisional Center (located in Rome) had acquired no full-time administrative or technical leadership, no technical staff, and no equipment. It had no stable budget or other financial support even remotely adequate for constructive long-range action [128]. Ultimately, the IMU did not get involved in the scientific use of computers. However, the Union kept mathematical computer science in mind. Three decades later it established the Nevanlinna Prize for the mathematical aspects of information science (Sections 10.3 and 11.6).

In Rome, the Statutes and By-Laws of the Union were discussed at some length. The important change was made to delete the provision by which "an individual or institution may apply for membership of the Union as a Contributor." Thus the membership of the IMU was limited to countries only.

Elections form an important part of the program of a General Assembly. The following Executive Committee, whose term started immediately and which was to be in office until 1 January 1955, was elected:

President: M.H. Stone (USA)

First Vice-President: E. Borel (France)

Second Vice-President: E. Kamke (Germany)

Secretary: E. Bompiani (Italy)

Other Members: W.V.D. Hodge (Great Britain), S. Iyanaga (Japan), B. Jessen (Denmark)

The Executive Committee was European, except for one member from the United States and one from Asia. This same pattern was preserved in the first eight Executive Committees of the new Union, that is, for thirty years. The Asian member was always from India or Japan. The first deviation was the Executive Committee for 1983–1986, which had four non-European members—from the United States, India, Japan, and Brazil.

It was more or less clear to all delegates that Stone, the forceful leader of the work that had led to the foundation of the new IMU, ought to be

FIGURE 5.3. Enrico Bompiani (1889–1975). Italian Secretary of the IMU 1952–1956, who set up the first Secretariat of the Union at the University of Rome.

the first President. Secretary Enrico Bompiani (Fig. 5.3) was President of the Unione Matematica Italiana in the years 1949–1952 and its Honorary President from 1952.

At the time of the Rome meeting, the Union was more bilingual than later. Both English and French were used. There was no need yet to balance between the West and the East, whereas some desire was expressed to have in the Executive Committee a suitable proportion between the "Anglo-American" and "Latin" blocs. An Italian Secretary was felt to form a good counterweight to the American President [129]. Yet no significant diversity appeared. President Stone's judgment that the work of the Union had begun in a cordial spirit was widely shared [130].

According to the Statutes, the unit contribution should be determined in gold francs, a gold franc being defined as 10/31 grams of 900 fine gold. It was decided that until the next meeting of the General Assembly, the unit contribution should be 200 gold francs, which was agreed to be equal

to $65.20. This ratio gold franc/U.S. dollar was employed until the 1974 General Assembly abandoned gold weight "as obsolete" (Section 9.2). In 1993 values, the 1952 unit contribution was about 350 U.S. dollars, or 515 Swiss francs [131].

From the start, the IMU adopted a philosophy of frugality. The following expenditure was approved for each of the years 1952, 1953, and 1954: secretarial help $1,500, office expenses $500, traveling expenses of the Executive Committee $750, emergency and reserve $1,215. This made a total of $3,965, which was expected to be covered by the income from members' contributions [125]. Thus the (small) income was used almost entirely for administrative purposes. All mathematical plans and activities were largely imaginary because the Union had practically no funds of its own for their implementation. The future of the Union depended essentially on support from UNESCO through the International Council of Scientific Unions (ICSU).

For this reason, there was a stringent need for the IMU to join ICSU at the earliest moment. The Interim Executive Committee had been aware of this and determined the timing of the first General Assembly accordingly. It was known that ICSU was going to hold a General Assembly in the beginning of October 1952 and that applications for membership had to be submitted at least six months prior to it. The decision of the Rome Assembly to apply for membership in ICSU led to the desired result: The 1952 General Assembly of ICSU in Amsterdam readmitted the IMU to the Council.

Until 1963 the unit contribution of the IMU was kept at $65.20. In the years 1953–1962 the average annual income of the IMU was about $15,000, of which a good two-thirds came from outside sources. The financial dependence of the IMU on ICSU is elucidated in quantitative terms in Section 11.1, which deals with the various aspects of the theme "IMU as a member of ICSU."

5.2 The Secretariat of the IMU

After the Rome General Assembly, the Secretariat of the IMU was organized in the Istituto Matematico, Città Universitaria, Rome, which became the official address of the Union. The Secretariat is the legal domicile of the Union, and the Secretary acts as the Treasurer.

According to the report of Secretary Bompiani, the personnel of the first Secretariat consisted of a multilingual secretary (typist) and occasional additional help for administration and general services. This was a modest arrangement for a world organization. What is remarkable is that the small size of the Secretariat has been kept over the years, even though the Union and its activities have grown considerably from the early 1950s. It has

become customary that the Secretary of the Union be assisted by a half-time Office Secretary. In addition, the Secretariat is helped by professionals in the accounting of its finances [132].

It is a characteristic feature of the IMU to minimize the size of its administration at all costs. Unlike some other ICSU Unions, which have permanent administrative offices with full-time employees, the IMU Secretariat is a rather abstract notion, often indicated by a small tag on the door of an office where work not connected with the IMU is done as well. That the IMU manages to make do with such a small administration finds its explanation in the Union's working philosophy. The IMU is, above all, a coordinating body. A multitude of tasks and projects are delegated to largely autonomous commissions, some permanent, some temporary. Once set up, they are usually only in light contact with the IMU Secretariat. The International Congresses of Mathematicians, with which the IMU became intimately connected in the late 1950s, provide a good example. The organization of an ICM requires tremendous effort. Yet once the site of the Congress has been decided upon and the Consultative Committee (later called the Program Committee), the Fields Medal Committee, and the Committee for distributing travel grants set up, the arrangements are almost entirely removed from the IMU Secretariat.

In spite of the policy of decentralization, many things must be taken care of by the Secretariat: Preparation of the meetings of the Executive Committee and the General Assembly, applications for membership in the Union and other correspondence with member countries, postal ballots, finances, connections with ICSU and other organizations related to the IMU, some contacts with the organizers of the ICMs, the Colloquia sponsored by the IMU, (later) editing the Bulletin, and miscellaneous correspondence with a great number of various commercial companies. This is routine and goes on regularly.[5] In addition, extensive ad hoc correspondence is unavoidable for a worldwide organization representing a large and steadily increasing number of mathematicians. (The 1994 *World Directory of Mathematicians* lists more than 40,000 names.) After a year as Secretary, Bompiani wrote that there was a tremendous amount of clerical work inside the Union that could not be performed without secretarial help.

In addition to the modest size of the secretarial office, Bompiani set another example that has been followed ever since. His report of February 1953 to the National Committees read, "The office of the Secretariat, as well as its lighting and heating, the use of the telephone, part of the furniture, and the use of mimeographing machines is offered freely by the Mathematical Institute of the University of Rome" [132]. Even after the Rome period, institutions in the home country of the Secretary have contributed towards

[5]The titles of the sections of the IMU Archives given in the Appendix, Section 13, illustrate in greater detail the various responsibilities of the Secretariat.

secretarial expenses. This outside support has gradually increased, and it has at times included a good part or even the whole salary of the Office Secretary. (It has always been taken as a matter of course that the officers of the IMU elected by the General Assembly serve without payment.) The generosity towards the Union coming from the Secretary's home country has been of great importance to the finances of the IMU.

From 1962 on, the expenditures in the IMU budget have been divided into two parts: schedule A for Administration, schedule B for Mathematics. The General Assembly has always approved the proposal of the cautious Secretary to reserve an adequate amount for secretarial costs. If there was no need to spend the entire amount, the rule could be applied that allows the Executive Committee to move funds from Administration to Mathematics (but not in the opposite direction). For years, the outside support for the Secretariat has made possible savings in schedule A. These funds have been moved to schedule B for unforeseen mathematical purposes or added to the Reserve Fund.

Until 1975 the Union had meager financial resources and lived largely on the support from ICSU and UNESCO. A considerable raise in dues in 1974 (Section 9.2) rendered the Union more independent. A decade later, the Reserve Fund had grown to such a size as to provide a rather solid foundation for the Union. After that, it has been possible not to raise dues by much more than an amount matching a conservatively estimated inflation, in spite of new plans and enlarged activities. (Some numerical information about the finances of the Union is provided in Section 11.1 and in the Appendix, Section 12.)

Following the Rome Assembly, the Secretary, in his capacity as Treasurer, opened three bank accounts for the IMU, one in Rome in Italian lire, one in Paris in French francs, and one in New York in U.S. dollars. His explanation for three different accounts in three different currencies was "to make it easier for the various nations to make their payments in the currencies they prefer; to provide funds for immediate disposal without exchange procedure; to avoid as much as possible (losses) in exchange" [132]. It soon turned out that the policy of using several currencies was more or less imposed upon the Unions by UNESCO, because part of its payments to the Unions had to be made in soft currencies (like French francs and Italian lire).

Bompiani's justifications for the use of different currencies have not lost completely their validity, but they are far less compelling today. The development in the IMU has been towards employing a single currency. First, the dollar gradually became dominant. The 1974 General Assembly decided that the currency of the IMU should be the Swiss franc. The dollar has not disappeared completely, since it is used by ICSU, which requires that its Unions present their financial statements in dollars.

In order to improve the Union's weak financial situation, the possibility was seriously contemplated during the preparatory stage before Rome of

admitting individual members to the Union. Stone was in favor of this, using as an argument the augmented income that this would bring to the IMU. The Executive Committee discussed repeatedly the need to seek contributions from foundations and even from commercial enterprises. As mentioned above, the support from ICSU and UNESCO was essential.

Later, when the finances of the Union gradually improved, a policy of remaining as independent as possible from outside agencies could be afforded. Today, connections with the business world are shunned instead of sought. When cooperation with developing countries grew in importance, voices were heard that the IMU should not become too wealthy. It might then attract interest from directions not purely mathematical or become involved in activities whose execution it might better leave to others. These arguments are in agreement with the spirit and mode of action prevailing in the IMU.

5.3 Starting the IMU's Activities

In Rome the starting signal was given to the IMU. Was it a new organization or was it the continuation of the old IMU founded in 1920? In 1932, the General Assembly of the IMU had set up a Commission to investigate the question of international collaboration in mathematics. During this period the Union was put into liquidation. A time limit was included in the resolution: The Commission was to present its recommendations to the 1936 International Congress. The Commission reported that it had not been able to arrive at a unanimous decision about an international organization of mathematicians. This statement, after being unanimously endorsed by the 1936 Congress, sealed the termination of the IMU.

In the old Union, the American views had grown from skeptical criticism to definite action to dissolve the IMU. In contrast, in setting up the new Union, the Americans had played a leading role. The *primus motor* Stone had more contempt than appreciation for the old Union, to which no reference was made when the new IMU was being prepared. For this total disregard there might have been the pragmatic reason not to recall the unhappy memories associated with the old Union. Be that as it may, the new IMU was explicitly disconnected from the old in that the 1952 meeting in Rome was called the First General Assembly of the IMU. This numbering of the General Assemblies has been followed ever since; the 1994 General Assembly in Lucerne was the twelfth. The name and, to a large extent, the statutes were taken from the old Union, but the four General Assemblies before the Second World War (or three by the counting adopted by the IMU Bureau after the 1928 Congress) were ignored.

The philosophy of keeping its distance from the past also prevailed in connection with a financial incident. The old IMU had some residual funds,

which were sent to Secretary Bompiani. To Bompiani's question as to whether this money could be regarded as automatically belonging to the Union, President Stone took a negative stand. He said explicitly that the present IMU is not a legal continuation of the old Union. On the other hand, it was taken for granted that these funds could be accepted by the IMU. After discussions about a suitable form, they were recorded as gifts [133]. In this case, the adopted policy had the advantage of ensuring that the new IMU would not be liable for claims or debts against the old.

In its application for membership in ICSU, the Union made no mention of its past adherence. However, ICSU had not forgotten. The new IMU was "readmitted" to the Council.

There are no records to indicate that the relation between the old and the new Unions was later discussed. It was implicitly mentioned by President Chandrasekharan in his address to the 1974 General Assembly in Canada, when he said that it was the first time that the Assembly was meeting outside Europe. Since the Assembly of the old Union had convened in Toronto in 1924, Chandrasekharan thus sided with the ideology of two separate IMUs. However, his attitude was not particularly dogmatic. In the report he submitted in 1964 to the ICSU Yearbook he wrote that the International Mathematical Union, in its present form, dated from the year 1952 and was the successor of a Union that had existed long before [134].

The question of the continuity of an institution is complicated. The political world offers examples in which an unsavory past has been wiped out, at least temporarily. Universities, as a rule, do not do this. They recognize their entire history and count their age from the first founding date. It does not matter what kind of past the university has had, whether it has been under foreign domination or its name has been changed or whether it has been relocated or closed even for extended periods of time. If university practice is followed, the age of the IMU should be counted from 1920.

As for the International Congresses, the ICM held in 1897 in Zurich was named the First International Congress of Mathematicians, the 1900 Congress in Paris the Second, and so on until World War I. After that, problems arose. Since there was disagreement as to whether or not the Strasbourg and Toronto Congresses, which were not open to all mathematicians, were ICMs, the practice was adopted in 1920 to designate the ICMs with the year in which they took place.

The work of the IMU is divided into the periods of four years that fall between two consecutive General Assemblies. A General Assembly is a point of discontinuity: A new Executive Committee is elected, a new budget is approved, preparations begin for a new International Congress. The time after the first General Assembly was exceptional. The statutes of the IMU link the General Assemblies with the ICMs. Since the second ICM after World War II was to be held during 2–9 September 1954 in Amsterdam, it was decided to hold the second IMU General Assembly in the Hague on 31 August and 1 September of that year. Thus the first working period, during

which many activities of the Union were initiated and the formation of many practices begun, was shorter than usual, two and a half years instead of four.

Bompiani's files from the period between the first and second General Assemblies contain a large number of letters. Besides Bompiani himself, President Stone, who was an active leader, was a frequent writer, making decisions and giving instructions and advice to others. Industrious also was Vice-President Kamke, who treated a variety of subjects with painstaking thoroughness. Many of the letters were written by hand, Kamke's mostly in German.

The correspondence reflects the difficulties under which the IMU began its work. There was no tradition on which to build. Administrative routines had to be developed from scratch, at a time when the world had not yet fully recovered from the war. Financial resources were very limited; bureaucracy hampered activities; the telephone was not of much use for international connections. Even many years later, meetings of the Executive Committee could cause difficulties, as visa requirements and nonconvertible currencies made traveling a complicated venture.

A good part of the early correspondence concerned member countries. Collecting dues proved problematic because more than once the bill was sent to an incorrect address. India had been active during the preparatory stages and had been given the privilege of appointing an additional member (Kosambi) to the Interim Executive Committee. But now India delayed joining the IMU. Many attempts were made, by way of Kosambi and over his head, to find out why. Greece was another problem. It was a member, but due to internal disagreements it was not clear who the national representatives were. This led to an extended correspondence entirely out of proportion to the situation. Peru had been one of the first countries to join the Union, but it soon announced that it was unable to pay its dues. The IMU statutes are explicit about the sanctions against a country that has arrears in its payments. However, the Union was reluctant (then as later) to take the ultimate step and dismiss a member for this reason. Gradually, it became clear that in Peru the number of research mathematicians, and consequently the interest in the Union, was very small. Peru withdrew from the IMU in 1954. Sweden had submitted an application to join the Union, and a postal ballot was arranged. This new procedure gave rise to many letters, partly because the Secretary found that the votes came in too slowly. The application of Malaya-Singapore caused much discussion as to whether it was a country in the sense of the statutes of the IMU.

Before the 1952 General Assembly of ICSU, Stone gave paternal advice to Bompiani and Jessen: "When you go to Amsterdam to attend the meetings of ICSU as observers for the Union, you will have a very good opportunity to obtain much useful, practical information about the operations of the Union. I believe you should learn everything you can by conversations with representatives of other Unions about their ways of treating problems in

international exchange, the collection of dues, the situations created by failure to pay dues, and so on. It would also be desirable to obtain all possible information concerning useful contacts which should be made with officers of ICSU and also of UNESCO" [135].

After Rome, admission of the new members followed the stipulations of the Statutes. A country wishing to join the Union submits an application to the Executive Committee, providing information about the National Adhering Organization and reporting the composition of the National Committee for Mathematics. The Executive Committee shall examine the application and make a recommendation thereon to the members of the Union. The members shall then accept or reject the application. This is done by postal ballot arranged by the Secretary if the application is handled between the General Assemblies.

The Executive Committee of the IMU held its first meeting in Paris, 13–14 February 1953, at the Institut Poincaré. This choice of site has been frequently followed afterwards: Paris has been the great favorite for the meetings of the Executive Committee. In the first years, the venue was several times the Institut Poincaré, later the Collège de France (see Figure 9.3 on page 186).

The question of sponsoring mathematical symposia was the most important item on the agenda of the first Executive Committee meeting. As mentioned above, there had been preliminary discussions about the symposia already before the 1952 General Assembly. In the application for funds from ICSU, the symposia were now uppermost on the list. Bompiani wrote that the tremendous importance of symposia of outstanding scientists to discuss definite problems was universally recognized. Having pointed out that some such symposia had been held in Europe through national initiatives, he added that should UNESCO grant a subvention, it would be possible to consider the opportunity of holding such symposia in different parts of the world [136]. At the time of the first Executive Committee meeting, the Union was already a member of ICSU, and a UNESCO contribution for mathematical activities could be expected.

The Executive Committee decided to draw up a report to the General Assembly in 1954 on the general principles and procedures for the organization of IMU-sponsored symposia. Two symposia were agreed upon already for 1953: a Symposium on Differential Geometry, to be held in Padua, Bologna, Pisa, 21–26 September 1953, under the joint auspices of these universities and the IMU; and a Symposium on Topological Groups and Their Representation (in Banach Spaces), to be held in the autumn of 1953 in the United States under the joint auspices of the National Research Council (USA) and the IMU [132].

These two symposia, in Italy and the USA, opened a long series of IMU-sponsored conferences. The Italian Symposium was truly international. Of the ninety-six participants, the Italians formed the majority, fifty-one, but the other forty-five came from fifteen countries on four continents. Two of

them were from the USSR, as a first indication of Soviet interest in cooperation with the IMU. The American Symposium, at Columbia University, New York, was different: twenty participants, eighteen from the USA, two from Germany.

Observing the resolution of the General Assembly to assist the organizers of the 1954 Congress in all possible ways, the Executive Committee had invited J.F. Koksma and H.D. Kloosterman, from the Dutch Organizing Committee, to attend a part of the meeting. It was decided to support the organization of three Symposia, on topics to be selected by the organizers of the Congress, to be held at the International Congress of 1954 with funds obtained for such Symposia from ICSU. The Executive Committee also put on record its intention of applying to ICSU for $5,000 to be used for the publication of the Proceedings of the 1954 Congress [132].

Since funds were scarce and the publication of the Congress Proceedings formed a relatively high portion of the expenses, there had been discussion already before the meeting as to the form in which the Proceedings should appear. The ICM-1950 had included in the Proceedings all lectures given at the Congress—invited lectures in extenso and short communications in an abbreviated form. Now, the view was widespread in the Executive Committee that only the invited lectures should be published in the Proceedings or that even they could better be published in regular journals. In contrast, the Dutch organizers preferred to follow the old tradition if possible. Ultimately, the Dutch view prevailed, and the 1950 model was followed.

In 1954, the role of the IMU at an ICM was still far from what it was to become in the late 1950s and what soon thereafter became permanent. In Amsterdam, the Dutch hosts carried all responsibility for the official mathematical program of the Congress. Even for the additional Symposia sponsored by the IMU the decisions were made by the Dutch organizers. At present, the scientific program is wholly determined by the IMU. Subsidiary activities carry an informal label, and if at all advertised in the Congress announcements, it is made clear that they are not part of the official mathematical program.

The second meeting of the Executive Committee was held again in Paris, at the Institut Poincaré, from 31 March to 1 April 1954. The discussions concerned principally the forthcoming second General Assembly. The Executive Committee recommended that the Assembly should conduct its elections "in a manner similar to that which was followed with success at the First General Assembly in Rome in 1952" [132].

This procedure was almost the same as the one now in use at General Assemblies. The Executive Committee prepares its own slate of officers and members of the new Executive Committee, after requesting proposals from the National Committees. The slate shall be made known to the National Committees not later than two months before the General Assembly. At the General Assembly, new names can be proposed in writing, provided that they are signed by at least ten delegates and contain a statement by the

candidate that he or she is willing to serve if elected. The General Assembly appoints a Nominating Committee, which shall propose a slate from the nominations made by the Executive Committee or from those that have come from the floor as described above. The voting slip distributed to the delegates shall contain all these names, but no others [137].

From time to time this procedure has been criticized by the Assembly as undemocratic. In practice, it is difficult to defeat the slate of the Executive Committee, which has almost always been adopted by the Nominating Committee and then by the majority of the General Assembly. In my memory, only a single deviation has ever occurred, in 1982. The argument used then was opposed to the principles of the IMU. The Nominating Committee removed a name from the slate of the Executive Committee on purely political grounds. The candidate's mathematical and other personal merits were unquestionable, but he was from Israel, whose actions in Lebanon were used against him.

At the 1958 General Assembly the procedure of electing the Executive Committee was criticized by S.L. Sobolev, a delegate of the Soviet Union. Of the reaction, the Secretary's official report states, "In his answer, the President [Hopf] agrees with Professor Sobolev that the EC's method of proposing candidates for the new EC was not quite satisfying but that he was convinced that it was the best possible" [189].

In fact, drawing up the slate for the whole Executive Committee is a complicated process. Since the 1960s, the Executive Committee has to appoint various committees whose mathematical expertise should be as deep and broad as possible. Therefore, the Executive Committee, taken as a whole, should itself fulfill this same condition. In addition, in electing its members, geographical distribution should be taken into consideration. Therefore, replacing one single name by another may shake the carefully conceived balance. The risk of this occurring is great when new names are proposed from the floor.

5.4 ICMI Becomes Attached to the Union

The Commission established by the Rome General Assembly to continue the work of the International Commission on the Teaching of Mathematics was called by several names in the years 1952–1954. They differed slightly in form if not in meaning. In the English version, which at that time was not yet predominant, the word "Instruction" was in more common use than "Teaching." Eventually, the 1954 General Assembly resolved that the name be "International Commission on Mathematical Instruction." The acronym ICMI, which soon became popular, was sometimes used even before this formal decision was made.

The Commission, with a long history going back to the year 1908 (Sections 1.3 and 3.2), had always been mandated only for the four-year periods between the International Congresses. However, this mandate had been reconfirmed so many times that the Commission had assumed a permanent character. Not only that, all countries with established secondary education had been invited to join the work of the Commission. The member countries paid a fixed contribution directly to the Secretary General of the Commission. Now it was a subcommission of the IMU, and it seems that before the 1954 General Assembly, it was not clear what this meant.

After the Rome General Assembly, President Stone stressed that one of the most significant tasks to be undertaken by the Union would be the continuation and expansion of the work of the International Commission on Mathematical Instruction. Stone wrote, "The problem of determining the place of mathematics [in society] cannot be divorced from technical considerations concerning teaching methods. If we judge by the results, we must find it difficult to escape from the conclusion that our attempts to teach mathematics as part of a program of mass education have so far been, to put it bluntly, a colossal failure, traceable to our ignorance and complacency in respect to the art of teaching" [130]. There is no doubt that the Commission on Instruction had the full support of the President of the Union.

The Commission took action without delay and held its first meeting in Geneva on 20–21 October 1952. Utilizing the freedom to decide about its internal structure and co-opting new members, it appointed a Governing Board of six, with Fehr as Honorary President, Albert Châtelet (France) as President, and Heinrich Behnke (Germany) as Secretary. It was also agreed to ask the British, Italian, and Danish National Committees each to name a Delegate to the Governing Board [138]. (For complete lists of ICMI's administrative bodies, see the Appendix, Section 6.)

As a deviation from the statutes of the IMU, the official languages of the Commission were agreed to be English, French, German, and Italian, as they had been before World War II.[6] At the Geneva meeting the Governing Board agreed "to ask the National Committee for Mathematics of each nation adhering to the IMU to name a representative to the Commission. They would be responsible in their own countries for the constitution of a national sub-committee made up of the representatives of the various schools and levels of teaching (primary, secondary, professional, technical

[6]When the Statutes of the IMU were being prepared, Stone argued for adopting only one official language, for practical reasons. He did not specify explicitly whether the language to be adopted should be English or French. Possible dispute over this issue never arose, because it was soon agreed that both English and French should be official languages of the IMU. In 1958 a third language, Russian, was added. Time has taken care of Stone's viewpoint. English has since been used so exclusively that for practical purposes the Union has become monolingual.

schools and university departments). The Commission would get in touch with the subcommittee in each country through the member named from the National Committee for Mathematics." Thus the Commission returned to the mode of action that had been applied and proved successful in 1908–1920 and 1928–1939. In a similar vein was the decision to let the periodical *L'Enseignement Mathématique*, which had served the old Commission, be the official organ of the new Commission also. At a stroke, the old Commission had been revived [139].

The Executive Committee of the IMU had mixed feelings about the steps the Commission had taken. On one hand, the activity of the Commission was welcomed. But the Executive Committee wished to exercise some control over its subcommission, which was supposed to be a link between research mathematicians and teachers and which did not possess financial resources of its own. The Executive Committee felt that it should have been consulted for such far-reaching resolutions that could imply unforeseen financial and other obligations. Friction between the IMU Executive Committee and the Commission soon began to appear.

Only two weeks after the Commission's meeting, Stone wrote to Bompiani, "... we can easily find ourselves in quite serious difficulties (largely because the Union is a union of adhering nations, not just a grouping of mathematical associations or of individuals). Hence I felt necessary to call M. Châtelet's attention to this matter" [140].

Further correspondence revealed more friction in the dialogue between the Commission's President, Châtelet, and the Executive Committee of the IMU. Bompiani tried to communicate with the Secretary of the Commission, but even Behnke had to admit that he was not too well aware of Châtelet's plans and actions [141]. In the summer of 1953 Stone uttered his dissatisfaction to Bompiani: "It is regrettable that the affairs of ICMI are in this state.... If it were not so important to have the Commission function actively and well, we could afford to let matters take their own course. As it is, there is no doubt that M. Châtelet must be encouraged to put the working procedures of his group in good shape as rapidly as possible [142]. Châtelet demanded that Bompiani's small office should do a good part of the secretarial work of the Commission. Having heard of this, Stone forbade anything of the sort being done, pointing out that the same amount of funds had been put aside for the secretarial expenses of the Union and the Commission. (The sum was very small. The IMU office managed to take care of its necessary secretarial work thanks to the generosity of the University of Rome, as told above.)

In the IMU Executive Committee it became increasingly clear that instead of the broad guidelines provided by the IMU by-laws, precise terms of reference were required to govern the activities of the Commission. A letter of May 1954 from Hodge to Stone described not only the feelings but also some of the reasons for the discontent:

> About ICMI, I agree very strongly that something must be done to curb its activities. At a recent meeting of our national committee very grave concern was expressed at the fact that so many of the Commission's activities were carried on behind our backs and that we were being let in for responsibilities we knew nothing about. They are demanding all sorts of things for individuals who have merely been asked to help in minor capacities, and their behaviour is quite unfair to these individuals and to the National Committee. I learn, too, that they are assuming quite unjustifiable rights in regard to their membership; e.g., they claim the sole right to replace any individual member who resigns. I think it will be necessary to lay down very precise terms of reference for the Commission, and to define its powers very rigidly. It will also be necessary to select a president very carefully. I agree that we should get rid of Châtelet [143].

For achieving good working conditions between the Union's Executive Committee and the Commission it was fortunate that the interval between the first and second General Assemblies was two and a half years instead of four. Appropriate administrative measures could thus be taken without too much delay. As a result of the resolutions of the second General Assembly, friction disappeared. Not permanently, though: It will be seen that a short-term lack of confidence developed between the IMU and ICMI in the late 1960s (Section 11.2).

At the 1954 General Assembly of the IMU, President Stone reported on the difficulties experienced by the Commission. Following the recommendations of the Executive Committee, which an ad hoc working Committee had carefully examined, the Assembly determined the terms of reference of the Commission. The substance remained intact: The objectives and the methods of their implementation already begun were endorsed in all essential points. The name "International Commission on Mathematical Instruction" was adopted. The acronym ICMI made the Commission more readily identifiable.

ICMI was clearly defined: It consists of ten members-at-large and two national delegates named by each National Adhering Organization of the IMU wishing to create, in agreement with its National Committee for Mathematics, a subcommittee to maintain liaison with ICMI. Precise rules concerning the Officers and the Executive Committee were given. For its internal organization and rules of procedure ICMI had a relatively free hand. However, at two important points the IMU retained its control. The President and the ten members-at-large of ICMI would be elected by the General Assembly of the IMU on the nomination of the Union's President [144].

The General Assembly decided that during his lifetime, Henri Fehr (Fig. 5.4) should remain Honorary President of the Commission "in recognition of his longtime interest in the cause of mathematical education and his de-

FIGURE 5.4. Henri Fehr (1870–1954). Swiss Honorary President of ICMI 1952–1954 and Secretary General of ICMI's predecessor, the Commission on the Teaching of Mathematics, throughout its existence 1908–1920 and after 1928. He proposed in 1952 that the Commission join the IMU. Fehr attended all of the first eleven International Congresses 1897–1950.

voted services to it." Fehr's record was impressive. In 1899 he had founded *L'Enseignement Mathématique* with Ch. Laisant and was the editor of this journal for fifty-five years, until his death. At the founding of the Commission on the Teaching of Mathematics in 1908, Fehr became Secretary General and held this position whenever the Commission was in existence before the 1952 Rome General Assembly. On his proposal, the Commission became a part of the IMU in Rome. Now his days were numbered. Fehr died only two months after the meeting of the Hague General Assembly, on 2 November 1954, at the age of 84.

The previous Secretary, H. Behnke, became the new President of ICMI. One of the ten members-at-large was Stone. His term as President of the Union was to terminate on 31 December 1954, putting an end to the "Stone Age," i.e., the preparatory and initial period of the new IMU under his stewardship. Four years later the Statutes of the Union were so amended that the past President became an ex officio member of the IMU Executive Committee for the next four-year period. In 1954 this was not yet so. Four years later Stone was elected President of ICMI.

The old Commission on Teaching had collected dues of its own, but now the members of ICMI did not pay any dues. In the IMU budget, only small amounts for administration were directly earmarked for ICMI. For scientific activities, ICMI had to rely on subventions from UNESCO and ICSU or submit an application to the IMU Executive Committee. This state of affairs was not changed until much later. From 1987 on, a part of the Union's budgeted expenditure for mathematics has been allocated for the free use of ICMI (Section 11.2).

5.5 The 1954 General Assembly in the Netherlands

The Second General Assembly of the IMU was held on 31 August and 1 September 1954 in the Hague (Binnenhof), the Netherlands. As in Rome, the site of the meeting was impressive. Binnenhof (Inner Court) is a group of buildings in the area of the thirteenth-century castle of the counts of Holland, around which the city of the Hague has grown.

The first General Assembly in Rome had made decisions on how to begin implementation of the Union's objectives. Now it was time to make the first evaluations of the activities launched in 1952. Some of them were interrupted, some were modified, and some were encouraged to continue. New actions were discussed, notably mathematical Colloquia, of which the first two had already been held prior to the General Assembly.

The question was raised as to what the General Assembly of the Union actually is. It is well-defined during the days it is in session, but normally the session lasts only a couple of days every fourth year. Stone offered the interpretation that between sessions the General Assembly would be the collection of the National Committees for Mathematics. It must have been a good answer, because apparently, not much interest has since been shown in this question.

The Executive Committee could report with great satisfaction the steady increase in the membership of the Union. At the beginning of the Rome Assembly in 1952, the Union had had eighteen member countries. Now this number had grown to thirty. (For lists of members, see the Appendix, Section 1.)

Two large issues dominated the meeting. One of them, ICMI, was described in the previous section. The other concerned mathematical Symposia, now called Colloquia, which were officially included in the Union's program. The Assembly fully endorsed the widespread idea that organization of conferences was an increasingly important means of promoting international cooperation in science.

After an extensive discussion, general rules were adopted for the organization of Colloquia:

> A colloquium is thought of as a meeting of a limited number of invited participants who are either experts or promising younger scientists, working in a field of current mathematical activity. This definition does not preclude the presence of a small number of other interested persons. The Executive Committee of the Union may take the initiative in the organization of a colloquium; but in general the Union will act as a co-sponsor for colloquia suggested by the National Adhering Organizations or by interested groups of mathematicians. The Executive Committee decides which colloquia should be organized or supported by the Union and seeks to obtain the necessary funds. The aim will be to support at least one colloquium each year. From time to time the Union may participate in the organization of joint colloquia with other Unions.

Instructions were given on how to apply for IMU support, which must be used exclusively for traveling and maintenance expenses of invited participants. The criteria the Executive Committee would take into consideration in setting up the program of the colloquia each year were explained, and detailed rules were given for the participation of the Union in the organization of colloquia that were arranged on its initiative or of which it was a cosponsor [144].

Supporting Colloquia grew to be an important part of the Union's activities. These began on a small scale, as can be read from the aim to cosponsor at least one Colloquium each year. "The Union seeks to obtain the necessary funds" was all that could be said about their financing at the time, because the Union's own budget did not stipulate funds for such purposes.

The Assembly surveyed the work of the ad hoc Commissions appointed by the Rome General Assembly. At the President's suggestion it was resolved to discharge the Commission on a Directory of Mathematical Symbols. The Commissions on Dissemination of Mathematical Knowledge and on Abstracting and Reviewing were consolidated into a single Commission on Scientific Publication. In spite of the transformation, satisfactory results were not achieved, and ultimately this Commission too was eliminated. The work of the Commission on the *World Directory of Mathematicians* will be discussed in Section 6.3.

The Executive Committee was asked to explore, in consultation with the International Union of Theoretical and Applied Mechanics (IUTAM), the desirability of making a proposal to ICSU to appoint a joint Commission of the IMU and the IUTAM and to take appropriate action thereon. Nothing resulted from this resolution. (Later contacts of the IMU with theoretical physics will be discussed in Section 11.6.)

The General Assembly delegated "the President and the Secretary of the IMU and a third representative in the person of Professor Iyanaga to consti-

tute together with the President and the Secretary of the ICM-1954 a joint Committee of the Union and the Congress. This Committee was charged with the duty of considering the time and place of the next International Congress of Mathematicians and reporting its recommendations thereon to the Plenary Session of the 1954 Congress on September 9, 1954."

This was a step towards restoring to the Union the authority to decide about the site of the ICMs. This Site Committee should actually have been appointed in Rome in 1952 to give it more time to compare candidates in case there had been competition for hosting the ICM-1958. As it was, there was only one candidate (the United Kingdom), reducing the work of the Joint Committee to a mere formality. On some later occasions, the Site Committee did not get off so easily.

As for the budget, the frugal line adopted in Rome was continued. Stone observed that the margin between expenses and income in the years 1955–1958 would become quite narrow. Yet he did not favor increasing the annual dues at that time but indicated that as the Union became more active it would need to have a larger income from dues. He commented that in the meantime the possibility of obtaining funds from individual contributors should be explored. The annual expenditure for 1955–1958 authorized by the Assembly against IMU funds amounted to $4,250.

The following Officers and Members of the Executive Committee were offered by the Nominating Committee for the period 1 January 1955–31 December 1958 and unanimously elected by the General Assembly [144]:

President: H. Hopf (Switzerland)

First Vice-President: A. Denjoy (France)

Second Vice-President: W.V.D. Hodge (U.K.)

Secretary: E. Bompiani (Italy)

Members: K. Chandrasekharan (India), J.F. Koksma (the Netherlands), S. Mac Lane (USA)

President-Elect Heinz Hopf (Fig 5.5), from Zurich, had not participated in the founding or administration of the Union, but as an eminent mathematician, he personified the IMU as a scientific organization. This was particularly important at the time when the IMU's image was still unformed.

The election of Komaravolu Chandrasekharan (Fig. 5.6) to the Executive Committee was the beginning of his extraordinary career at the IMU. He remained twenty-four years in the Executive Committee without interruption, first as a Member, then as Secretary for five years, and then again as a Member until the end of 1970. Having also held in the 1960s the office of Vice-President and then that of Secretary General of ICSU, he was elected President of the IMU in 1970. Thus he remained eight more years at the

FIGURE 5.5. Heinz Hopf (1894–1971). German-born professor at the Federal Institute of Technology, Zurich (differential geometry and topology). President of the IMU 1955–1958 and Chairman of the Fields Medal Committee for the Edinburgh Congress 1958, Hopf advocated in 1958 that the Union take part in the planning of the mathematical program of the ICMs.

Executive Committee, as President and Past President, until the end of 1978. His devotion, expertise, and influence with respect to the Union were unique.

5.6 ICM-1954 in Amsterdam: Comeback of the Old World

The 1954 International Congress of Mathematicians was held in Amsterdam immediately after the Hague General Assembly, on 2–9 September. The helping hand of the IMU was not yet available, but the long tradition of the ICMs guided the Dutch organizers. The first task of the Organizing Committee (with J.A. Schouten as Chairman and J.F. Koksma as Sec-

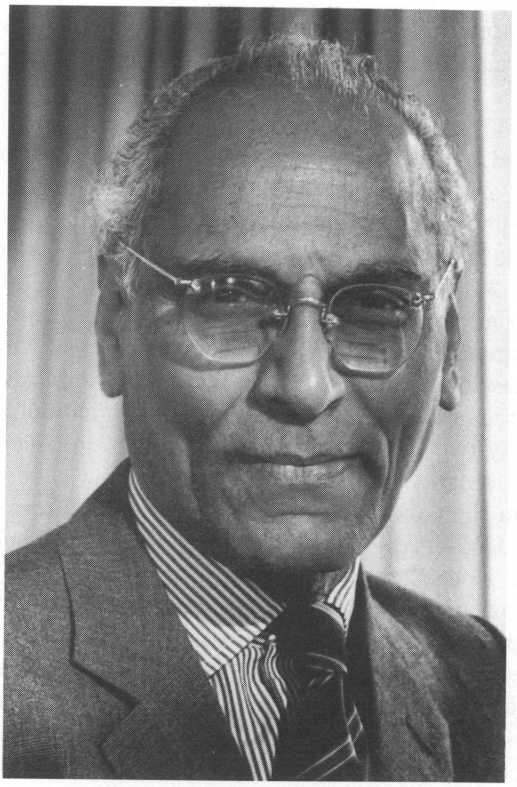

FIGURE 5.6. Komaravolu Chandrasekharan (born 1920). Indian mathematician (analytic number theory). Member of the Executive Committee of the IMU 1955–1978, Secretary 1961–1966, President 1971–1974. Member of the Consultative Committee for the Stockholm Congress 1962. Member of the Fields Medal Committee for the Edinburgh Congress 1958 and Chairman ex officio for the Vancouver Congress 1974. Chandrasekharan moved in 1965 from Bombay to Zurich. For decades he was a *spiritus rector* in the Union.

retary) was to draw up a report on the structure and regulations of the Congress. Following time-honored practice, they decided to invite about twenty mathematicians to deliver one-hour plenary lectures and about forty experts in the various main branches of mathematics to give half-hour lectures. The list of invited speakers was produced by the Dutch Program Committee. Short lectures could be given by members of the Congress expressing a wish to do so. All languages would be admitted, though for technical reasons the secretariat in its foreign correspondence had to restrict itself mainly to English, French, and German.

The first communication of the Congress was sent out in early 1953. In the long list of addressees, National Committees for Mathematics of the IMU were not mentioned. In contrast to the current policy of keeping

the Congresses apolitical, the Dutch Ministry of Foreign Affairs sent out invitations to foreign governments asking them to nominate representatives to the Congress.

If the ICM-1950 had been a markedly American event, the Amsterdam Congress signified a comeback of the Old World. Of the more than fifteen hundred regular members, over seventy-five percent were Europeans. In 1954 travel still had its problems, and only ten percent of the participants were from outside Europe or the United States. Of the national contingents, the largest were 261 from Great Britain, 228 from the United States, 212 from the Netherlands, 207 from Germany, 138 from France. One-third of the invited lectures were given in a language other than English. This was the second-highest figure of all postwar ICMs. At the Moscow Congress in 1966 the percentage was fifty-five, because of the high number of talks given in Russian (thirty-two per cent). At the ICM-1970 in Nice the percentage of English was seventy-seven; at the ICM-1994 in Zurich it was ninety-five.

In Amsterdam the participation of mathematicians from the USSR, the first time at an ICM since 1932, drew special attention. Their presence was not unexpected, since they had already attended an IMU Symposium in the previous year. Although the low number, five, was a disappointment, their participation was seen as an indication of the desire on the part of the USSR to return to international cooperation in mathematics.

At present, the President of the Congress is elected on the recommendation of the President of the IMU. In Amsterdam the ritual was different. At the opening session, Oswald Veblen took the floor, saying that in order to symbolize the tenuous continuity between the Congresses, the President of the old Congress emerges for a moment from the obscurity in which he belongs to propose the name of the person selected by the hosts of the new Congress to preside over it. Veblen's proposal to elect Professor Schouten as President of the Congress was accepted by acclamation. Schouten's presidential address centered largely on the topic, "Why to organize large ICMs," which is the title of Section 7.3. Excerpts of his address are therefore presented there.

An exception from the rule that all arrangements of the Congress were to be in Dutch hands was the work of the Fields Medal Committee. Although the Committee's members were appointed by the Dutch, none of them were from the Netherlands. The Chairman was Hermann Weyl. (For a list of members, see the Appendix, Section 9.)

The announcement of the winners of the Fields Medals was, as always, an important item on the program of the opening session. Weyl presented the Medals to Kunihiko Kodaira, Princeton University, USA, who before moving to the United States in 1949 had studied and taught mathematics at Tokyo University; and to Jean-Pierre Serre, Collège de France, Paris. In awarding the prizes, Weyl repeated the donor's words that the prizes are in recognition of past, and encouragement of future, research work. Of Kodaira, Weyl said: "Kodaira's outstanding achievement lies in the theory

of harmonic integrals and the numerous profound applications he made of it to Kählerian and more specially to algebraic varieties." Speaking of Serre and having referred to the close connection of part of his work with that of Kodaira, Weyl continued, "Hearing this, you may get the impression that our Committee did wrong in awarding the Fields Medals to two men whose research runs on such closely neighboring lines. This contact, however, has been established only during the last year.... Serre's work before, which above all fascinated our Committee by the wealth of its surprising numerical results, is concerned with quite a different problem, the homotopy theory of spheres" [145].

The contribution of the IMU to the mathematical program was small and invisible. The following statement can be read in the Proceedings of the Congress: "In connection with the Congress, although organized independently by the *Wiskundig Genootschap*, three symposia took place with the moral and financial aid of UNESCO, ICSU, and IMU." These symposia were on stochastic processes, algebraic geometry, and the mathematical interpretation of formal systems. Some of the lectures were given in joint sessions of the Congress and the Symposium.

At the closing session of the Congress, Schouten spoke on behalf of the joint committee of the IMU and the Congress "for the preparation of the discussion on the place of the next Congress." He said that the committee had received one letter only, from Professor Hodge, and invited him to take the floor. Hodge conveyed the invitation from the mathematicians of Great Britain and Northern Ireland to the mathematicians of the world to hold their next Congress in Edinburgh in 1958. The invitation was accepted unanimously [145].

6

Expansion of the IMU (1955–1958)

Since the 1950 constitutive meeting in New York, the Union had been working actively in order to enlarge its membership. A special effort was made in advance of the 1954 General Assembly. Invitations to join the Union were then sent to eighteen countries. Of these only three responded, and they were admitted to the IMU, yet an important expansion was forthcoming. During the years 1956–1958 six Socialist countries of Europe, among them the USSR, joined the Union. Mathematically, this was an essential gain. In addition, through these new members the IMU faced the task of promoting mathematical cooperation across the Iron Curtain. At the same time, discussions about membership of the People's Republic of China and the Republic of China (Taiwan) to the IMU revealed the complications of the Chinese question.

In producing the *World Directory of Mathematicians*, the IMU decided to include in it mathematicians from countries that were not members of the Union. In this way, the IMU established extensive worldwide contacts at an early stage.

The support from the Union made it possible to organize international mathematical conferences in Japan in 1955 and in India in 1956. This made history: It was the first time that such conferences had been held in Asia.

6.1 Membership of Socialist Countries

The membership of Poland in the IMU in July 1956 signaled a new policy of the Socialist countries of Europe towards the Union. On 1 March 1957 the USSR became a member. Bulgaria, Czechoslovakia, and Hungary were admitted in May 1957 and Romania in March 1958. The applications of these countries were unanimously accepted by all the Union member countries that took part in the voting [146]. These new memberships represented an essential enlarging of the sphere of the Union.

In the files of the IMU the first letter from the Soviet Union regarding possible membership is dated August 1955; the Soviet Academy of Sciences requested material relating to the activities of the IMU. Formal application to join the Union was sent in May 1956. A final decision was delayed because the composition of the Soviet Committee for Mathematics was made known only in December 1956. The Committee consisted of five academicians: I.M. Vinogradov (President), N.N. Bogoliubov, M.A. Lavrentiev, P.S. Aleksandrov, and S.L. Sobolev.

The membership of the USSR was important for the simple reason alone that the volume of mathematical research there was second only to that of the United States. After 1936, Soviet mathematicians had been virtually isolated from the West. Now there were high hopes that through the IMU, new possibilities would open for mathematical contact that had previously been hindered by the Iron Curtain.[1]

The weight of the USSR was immediately felt. The 1958 General Assembly amended the Statutes of the IMU so that Russian became the third official language, in addition to English and French.

In addition to its mathematical importance, the adherence of the USSR to the IMU (and more generally to ICSU and its Unions) was a remarkable event in a world whose politics was dominated by the existence of two opposing camps. The Cold War seemed to be a permanent state of affairs. A new feature was thus brought to the life of the Union. It became one of the central tasks of the IMU to maintain good mathematical cooperation across borders, irrespective of the political climate. The basic doctrine was to keep politics away from mathematics, a doctrine that had been stressed already in connection with the ICM-1950 and the preparation of the statutes of the IMU. As will be seen later, it was not always easy to follow this simple principle in real life. The time span for a retrospective look is still short, but it seems that by unswervingly preserving its apolitical, purely scientific image, the IMU lived rather well through the difficult years. More will be said about this later, especially in Chapter 10.

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[1] In the 1950s, it was customary to speak about Iron Curtain countries, an expression that also appeared in some early documents of the IMU. With the consolidation of the status quo in Europe, the locution became less common. It was not in conformity with the notion that the IMU is a large mathematical family transcending national borders.

The apolitical character of the IMU was important. Examples showed that the USSR was wary of being associated with organizations with a Western flavor. The IMU was a member of ICSU, which, even though nongovernmental and independent, was "in consultative status" with the political organization UNESCO. But UNESCO was not a hindrance. The Soviet Union had joined that organization in 1954. In the same year, the USSR also became a member of ICSU, giving a signal that membership in the IMU might well be expected.

When the idea of establishing a European Mathematical Society began to ripen in the 1970s, the first contacts with national organizations were taken through the Council of Europe. At that time, the Council of Europe had a political coloring. Not even all the neutral countries of Europe were members. Although the initiators always emphasized the apolitical, purely mathematical character of the planned Society, the initial damage was irreparable. From the discussions that took place during the ICM-1978 in Helsinki, the negative stand of the USSR was clear. The European Mathematical Society could not be founded as a Pan-European organization until 1990.

In 1957, the IMU sponsored a Colloquium on the Theory of Analytic Functions in Helsinki [147]. For the first time after World War II, a sizable group of Soviet mathematicians then visited a non-Socialist country (thirteen, under the leadership of M.A. Lavrentiev). The organizers of the 1958 Edinburgh Congress were curious to know the "Helsinki formula" that had attracted such considerable Soviet attendance. Alas, there was no formula. Later experience showed that contacts with Soviet colleagues depended on decisions made in Moscow and that these correlated with the political climate.

Stalin's death, in 1953, was a point of discontinuity. Before then, the IMU was unable to establish contacts with the USSR. Later, in accordance with Soviet attempts in foreign affairs to create a better climate in its relations with the West, indications of the desire of Soviet mathematicians to take part in the activities of the Union appeared without delay and kept increasing. Even though the political barometer soon fell, the Khrushchev era represented a new liberalism in the Soviet Union. The positive development in relations between the IMU and the Soviet mathematical community culminated at the 1966 International Congress in Moscow (Section 8.2).

Then times changed. Throughout the 1970s, the IMU was in disagreement with the National Committee of Soviet Mathematicians about the programs of the ICMs. Relations reached their lowest point at the end of 1979 (Sections 9.3, 9.6, and 10.1). They improved thereafter, but American intervention on account of the position of Jewish mathematicians in the USSR created a new problem (Section 10.5). This problem was eventually overcome, and not many years after that, the Soviet Union ceased to exist.

As soon as the USSR had joined the IMU, it was taken as a matter of course that one seat in the Executive Committee "belonged" to a Soviet

mathematician.[2] In the years 1959–1970, first P.S. Aleksandrov and then M.A. Lavrentiev were members of the Executive Committee. Aleksandrov, of prewar Aleksandrov–Hopf fame, was well known to favor contacts with Western colleagues; and the influential Lavrentiev, "Emperor of Siberia," represented the same ideology. L.S. Pontryagin, who succeeded Lavrentiev in the Executive Committee in 1971–1978, was different. It is tempting to conclude that the persons of Aleksandrov, Lavrentiev, and Pontryagin reflected the prevailing political climate in the Soviet Union, and that consequently, political power had loomed indirectly behind the Soviet attitudes. This may contain part of the truth, but some incidents proved that it was not the whole truth. Vinogradov served as Chairman of the National Committee of Soviet Mathematicians from the foundation of the Committee in 1956 through different political vicissitudes until his death, in 1983. In 1979, he and Pontryagin were forced to retreat from their anti-IMU stand by the Soviet Academy of Sciences (Section 10.1).

Throughout the years, the Executive Committee of the IMU was under the impression that the great majority of their Soviet colleagues were in favor of international collaboration.

In the early 1960s, another Socialist state caused considerable discussion and correspondence in the IMU. After the war, Germany was divided into four occupational zones. In 1949, two states were created, the Federal Republic of Germany, consisting of the zones of the U.S., the U.K., and France, and the German Democratic Republic of the Soviet zone. At that time and for many years later they were called West and East Germany.

The country that had joined the IMU in 1951 among the first ten was called Germany. In spite of political difficulties, it was possible to have a common representation for mathematicians of West and East Germany. Thus East Germany was the first Socialist country whose mathematicians became attached to the Union. It was not until about ten years after its foundation that East Germany began to pursue actively the policy of identifying itself as a sovereign state and sought recognition of this status from countries outside the Socialist bloc. In accordance with this development, it insisted that it should be an independent member of ICSU and its Unions. In contrast, the politics of West Germany rested on the principle that there exists only one Germany. A disagreement between West and East Germany about membership in the IMU was inevitable.

In October 1960, the President of the (West German) Deutsche Forschungsgemeinschaft wrote to the President of ICSU [148]:

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[2]In 1990, the USSR felt that having only the Past President in the Executive Committee was not sufficient. The demand for a second Soviet member did not find enough support and was ultimately dropped. The United States provided a counterargument: In 1979–82, the only American in the Executive Committee was the Past President Montgomery.

> Since 1945 scientific contacts between West and East Germany have been maintained first and foremost by the scientific societies. Personal contacts between scientists have facilitated that all-German mission. Cooperation has indeed been running comparatively smoothly, save for the impediments resulting from postwar conditions. In fact, the less interference there was from political factors and the less the free exchange of opinions was hindered by party directives, the better was that cooperation. For some time, however, it has been noted that Eastern German scientists are induced to attempt detachment from all-German groups with a view of forming independent representative groups in international organizations. Such notions are obviously intended to serve political objects and are apt to hamper international scientific cooperation. On the other hand, our consistent policy of maintaining joint representation from the whole of Germany in international organizations is certainly in the interest of maintaining the apolitical character of science and is also in conformity with the "policy of political non-discrimination" as pursued by the International Council of Scientific Unions. I would therefore request the Executive Board of the International Council of Scientific Unions to reject the separate admission of the East Berlin Akademie as a "national member" and to ask the Akademie and the Deutsche Forschungsgemeinschaft to form a joint representative group to represent Germany.

This West German way of thinking found understanding among members of the Executive Committee of the IMU when East Germany submitted an application for independent membership in early 1962. President Nevanlinna emphasized in his letter to the Deutsche Akademie der Wissenschaften zu Berlin that in view of the good cooperation of all German mathematicians heretofore, it was felt within the IMU that its activities should be organized along scientific lines and kept separate from politics [149]. On the same day, Nevanlinna wrote to the (essentially West German) Mathematical Society (DMV) asking for their opinion. The answers from East and West were at odds. The Academy in Berlin was astonished that Nevanlinna could be skeptical about the rightful application of East Germany [150]. The DMV required several months to form a considered opinion. In December 1962, the Society announced that they had gained the impression that the overwhelming majority of German mathematicians in the East and the West wished to have a united representation in the IMU, through the auspices of the DMV [151].

After much correspondence, the political reality that there were two States in Germany was ultimately decisive. In 1963, voting by postal ballot was conducted regarding the application of East Germany to join the

Union. The results were thirty-nine in favor, ten opposed, seven abstentions [152]. At the beginning of 1964, East Germany became a member of the IMU. Nothing else was done, and thus the two German members of the Union were Germany and East Germany. This remained so for several years, until the 1970 General Assembly, following requests from both parties, resolved that the name East Germany be changed to German Democratic Republic (GDR) and Germany to Federal Republic of Germany. At the same time, the Assembly approved a motion to change the status of GDR from Group I to Group III. (The Federal Republic of Germany inherited the status of Germany in Group IV.)

In 1990, the Academy in Berlin informed the IMU that since the German Democratic Republic had ceased to exist, the membership of the GDR in the Union had terminated. Thus the circle had closed, and the IMU had again the member Germany.

Secretary Bompiani had been in active correspondence with the USSR and the other Socialist countries of Europe about their joining the IMU. When these countries had finally become members, there was a new Secretary. Bompiani had found himself compelled for reasons of health to tender his resignation. In May 1956, the Executive Committee appointed Beno Eckmann (Fig. 6.1), of the Eidgenössische Technische Hochschule, Zurich, to succeed him [153].

6.2 The Chinese Problem Emerges

After the Socialist countries of Europe had joined the IMU, the most serious gap in the Union's membership was the absence of the People's Republic of China. The first contact with China had been taken by the interim Secretary Jessen as early as February 1951, even before the IMU was formally in existence. In January 1952, Jessen repeated the wish that China join the Union, informing the Chinese that the IMU had been established and giving them the list of the sixteen member countries. At that time, the USSR and the other Socialist countries in Europe had not yet joined the Union. China decided to wait [154].

According to the files of the IMU, a reply from the People's Republic of China did not come until February 1955. The Chinese problem surfaced immediately. In a letter to Secretary Bompiani, two questions were asked: "1. Whether there are Taiwan participants in the committees of the International Mathematical Union or not? 2. Whether you have invited Taiwan to participate in the next year's General Assembly or not?" The letter ended with polite phraseology, without comments on the questions asked [155]. Since Taiwan was not a member of the IMU, Bompiani's answer to both of these questions was negative.

FIGURE 6.1. Beno Eckmann (born 1917). Swiss mathematician (topology). Member of the Executive Committee of the IMU 1955–1962, Secretary 1956–1961. Member of the Consultative Committee for the Stockholm Congress 1962. Honorary President of the Zurich Congress 1994.

Interest in the IMU on the part of the People's Republic of China continued. A decisive step was taken in February 1957 (at the time when the Socialist countries of Europe were in the process of joining the Union). Lookeng Hua, the President of the Chinese Mathematical Society, informed Secretary Eckmann that the Chinese Mathematical Society had decided to join the IMU. The composition of the Chinese Mathematical Committee was given and the wish expressed to join in group V, the highest group. Hua's letter concluded with the declaration that the Chinese Mathematical Society of the People's Republic of China should be reckoned as the sole authorized academic society of China and that Taiwan was not qualified to represent China [156].

In his reply, Eckmann, pointing out first that China's application had to be settled by a vote, expressed doubt that the majority of the members would agree to the placement of China in group V and suggested group III

instead. Regarding Taiwan, Eckmann wrote that the IMU considered the People's Republic of China and Taiwan as two independent "countries." He stressed that according to the Union's statutes, the word "country" was not meant in the political sense but as any territory in which independent scientific activity in mathematics had developed. Therefore, after the admission of the People's Republic of China, the position of the IMU with respect to Taiwan would be the same as with respect to any other independent "country" that was not a member of the IMU [157].

Hua's response concerning Taiwan was unyielding: "Taiwan can never be qualified to join the Union. Your interpretation on Taiwan in the letter is, to my ideas, incorrect. It is well known that Taiwan is an integral part of the Chinese territory; it is anything but an independent "country," nor an independent region. Now owing to the obstruction of foreign powers, Taiwan has not yet returned to the embrace of the People's Republic of China, but it will be after all liberated." The concluding remark left no doubt about the stand of Beijing: "If the Chinese Mathematical Society of the People's Republic of China has joined the International Mathematical Union, the mathematicians in Taiwan, like all other mathematicians of our country, could participate in the activities of the International Mathematical Union only under the condition that they become members of, and have the consent of, our society [158]."

This statement was discussed by the Executive Committee of the IMU at its meeting in October 1957 [159]. The Executive Committee felt unanimously that it could not recognize this point of view. The opinions formulated in Hua's communication were in agreement with neither the letter nor the spirit of the statutes of the Union, statutes that the Executive Committee was bound to honor.[3]

The disagreement between the IMU and the People's Republic of China proved insurmountable. Contacts were broken, and it was two decades before they were renewed (Section 10.6).

Shortly after all hope had been lost that the People's Republic of China would become a member of the Union, the Republic of China (Taiwan), on 15 May 1958, applied for membership. It soon became apparent that this application was also problematical.

In answer to Eckmann's letter to the members of the Executive Committee about this application, Hodge replied, " I foresee trouble with the other China.... If Peking causes difficulties, we shall have to repeat firmly that the term "country" is not necessarily to be understood in the usual political sense. It will be a great pity if Taiwan's membership keeps out Peking, but at all costs we must avoid taking political sides" [160]. This was precisely

[3]Outside the IMU, other voices were heard: Taiwan should not be allowed to hinder the adherence of the People's Republic of China to ICSU and its Unions.

the reasoning the Union adopted in the 1970s and 1980s, when the People's Republic of China expressed again its wish to join the Union.

After some changes to the draft letter, Eckmann sent the answer suggesting that the Chinese Mathematical Society in Taiwan apply for membership in the IMU as the Adhering Organization of Taiwan; that is, the Society would represent the mathematicians living in Taiwan" [161]. This formulation was not satisfactory to the Society's President, Professor Kwan, who reacted less than two weeks after Eckmann had sent his letter: "On behalf of the Chinese Mathematical Society, I wish to express once again our sincere desire of joining your union as a national adhering organization of the Republic of China in Group I. The title of our society is not the Mathematical Society of Taiwan, for Taiwan is not the name of our country but a geographical term only.... We believe that you will grant us our application in accordance with our desire, and process it in due form and time" [162].

The problem was now well-defined. In his next letter to Taiwan, Eckmann tried to avoid direct confrontation. He wrote that it was necessary to clear up the following two points: 1. The Chinese Mathematical Society wished to be admitted to the IMU as National Adhering Organization of the Republic of China and as such to represent the mathematicians living in Taiwan. 2. It was the opinion of the Executive Committee of the IMU that the "Republic of China" and the "People's Republic of China" were two different countries in the sense of the term "country" as explained in article 5 of the IMU Statutes [163]. A reply to this letter has not been found in the files of the IMU. But consensus must have been reached, because the Executive Committee recommended to the National Adhering Organizations that China (Taiwan) be admitted to the Union.

A postal ballot was arranged, and on 30 December 1958, Eckmann announced the result of the vote on "the application of the Chinese Mathematical Society (Taipei, Taiwan) for admission to IMU in Group I as adhering organization for the Republic of China (Taiwan)." The total number of votes of all IMU members was 82. "Yes" votes, 43; "No" votes, 23; total of votes cast, 66. Therefore, the application was accepted [164].

The Executive Committee found it advisable to enclose with this announcement a letter, signed by Hopf and Eckmann, clarifying once more the position of China (Taiwan):

> In our Statutes and also in the Statutes of ICSU and of its other adhering Unions, the term "country" is to be understood in a non-political sense; it designates a geographical region where there is independent significant activity in the field of science concerned. The adherence of a "country" in this sense to a Union or to ICSU does not involve the recognition of its government or of any particular political status. This attitude has been explicitly confirmed by the 8th General Assembly of ICSU, held

> in Washington, October 1958, where the resolution on political non-discrimination was unanimously approved by all delegates from the various Unions and the national members of ICSU.

The letter concluded with an appeal to the People's Republic of China:

> The Executive Committee of IMU has long felt it important and desirable that a country of the mathematical standing of the People's Republic of China should become a member of the Union. For several years the Executive Committee has corresponded on this possibility with the Chinese Mathematical Society (Peking). Our last letter, sent November 2, 1957, expressing the sincere wish of the Executive Committee that the People's Republic of China might join the Union, has not yet been answered. We hope very much to receive soon an appropriate application for membership from the People's Republic of China. We trust that such an application would be enthusiastically accepted by all our present members and we should appreciate your cooperation in encouraging our Chinese colleagues to present such an application [164].

Much time and effort were still needed: The People's Republic of China did not become a member of the Union until 1986. During the long negotiations preceding its joining, the representatives of the Union learned that there was only one China. On this point, Beijing and Taipei were in agreement. Thus to have both the People's Republic of China and the Republic of China in the Union required a particular formula, which will be described in Section 10.6.

6.3 The *World Directory of Mathematicians*

At the Rome General Assembly in 1952, the Commission for the World Directory of Mathematicians (WDM) was established. The Commission appointed Stone as Chairman. In June 1953, a formal agreement was reached between the IMU and Butterworths Publications Ltd., London, concerning the preparation of the WDM. According to the agreement, Butterworths would compile and prepare the manuscript at its own expense. The IMU would set up a special committee to provide technical assistance and advice in the preparation of the manuscript. The IMU would pay to Butterworths $1,000 in each of the years 1953 and 1954. If the manuscript was acceptable to the IMU, it would be published under the sponsorship of the Union on terms mutually agreed upon [165].

A joint meeting of the IMU Commission and representatives of Butterworths was held in London in November 1953. The problem of how to collect names was widely discussed. It was agreed that the information requested

for the list include name, status, place of employment, mailing address, and year of birth. The country of domicile should stand out prominently. The basic difficulty, the definition of a mathematician, was left to be decided after the complete list became available.

In London, the important decision was made to include in the Directory mathematicians from countries that were not members of the IMU. Consequently, countries around the world were requested to submit address lists of their mathematicians. The returns gave a first taste of the difficulties. The total number of names, twenty-five thousand, was unexpectedly high, and it was clear that no uniform criteria had been applied for inclusion. After much discussion in the WDM Commission, another approach was made to the national mathematical bodies. They were asked to reduce their lists to comprise only those mathematicians whose scientific or other contributions to mathematics (as measured, for example, by publications reported in the reviewing journals) constituted a clear basis for inclusion. However, once again, no precise rules for inclusion were imposed. Secretary Bompiani stated explicitly that countries could not be forced to accept criteria dictated by the IMU. As a result of this second round, the list was reduced to about ten thousand names, but still without uniformity. Butterworths was dissatisfied, complaining, for example, that the Iron Curtain countries had included everybody. The pity of the Union was requested for the poor publisher, who in the first place had to compose the basic list [166].

Problems now started to mount. The option was still held open that the WDM should be not only an address book, but preferably a kind of "Who's Who in Mathematics," with various bibliographical information with each name. For this reason, Butterworths wished to send a questionnaire to each of the ten thousand mathematicians on the reduced list; the costs of the inquiry should be divided evenly between the Union and the Publisher. This idea had some sympathy within the WDM Commission; Hodge especially was in favor of it. However, Chairman Stone, who felt that the list was still far too large, was definitely against the proposal. Relations with Butterworths became strained. In the spring of 1956, first Hodge, and a little later Stone, tendered their resignations from the WDM Commission.

At its meetings in Paris in May 1956, the Executive Committee recognized the serious situation that had arisen. An appeal was made to Stone that he remain Chairman of the Commission. The Executive Committee decided no longer to consult national committees regarding the final revision of the list. Instead, a small panel under the chairmanship of Stone would have full authority for the list [167]. Stone replied that he would be willing to undertake the task of revising the list as an agent of the Executive Committee in whatever way seemed best to him as the responsible person. But, Stone continued, the circumstances pointed out only too clearly the desirability of finding a new chairman who would be able to obtain the cooperation of both his colleagues and the publisher in solving the new problems certain to arise [168]. Thus Stone resigned from the Commission,

whereas Hodge finally agreed to remain and assume temporary chairmanship.

Stone now set to work in Chicago. The names of those on the existing Butterworths list who met the test of having published two or more articles reviewed in Mathematical Reviews since the journal had begun publication in 1940 were automatically transferred to Stone's list. This checking was done by the Division of Mathematics of the United States National Research Council, which underwrote the cost of the work. The remaining names, which formed the large majority, were subjected to careful scrutiny. Stone, Ralph Boas, and Jean Dieudonné (who was in Chicago at the time) carried out this part of the work. A number of other mathematicians examined portions of the non-U.S. list: S.S. Chern (China, Formosa), A. Zygmund (Poland), P.R. Halmos (Hungary), L. Nachbin (South America, Mexico), A. Caldéron (Argentina, Brazil), L. Gårding (Sweden, Denmark, Finland, Norway) and O.F.G. Schilling (Germany). The resulting list comprised about three thousand names. The only countries for which reasonably adequate lists were lacking were the USSR and Czechoslovakia [169].

Stone's part of the work was completed by March 1957. President Hopf expressed his satisfaction to Stone: "Without your assistance this project would certainly be in a hopeless state today. The way things are now, there is good reason to believe that this project will achieve a good result by summer 1958." Stone's revised lists were sent to Butterworths, and their questionnaires were dispatched in early July 1957 to all mathematicians named in these lists. The name, address, present appointment, and date of birth were to be printed in the Directory, while sphere of interest, previous appointments, national academies, and senior academic degrees were requested for the files of the IMU. Finally, the recipient could fill out an order form to purchase the Directory.

If there had been optimism about the forthcoming final act, it was soon shattered. By mid-September 1957, only nine hundred of the three thousand had responded, and of these, a mere three hundred had filled out order forms. From these figures it was estimated that the total number of replies would be at most twelve hundred, and that not more than four hundred of these would place an order. Butterworths, whose calculations were based on about two thousand orders, took a very pessimistic view of the situation and indicated that they could not proceed with publication of the Directory. As a way out, they offered to prepare a small Vari-type volume of the existing slips [170]. The Executive Committee decided not to accept the proposal. Further discussion about the WDM was postponed to the meeting to be held in the spring of 1958 [171]. Cooperation with Butterworths was terminated. They were requested to send all material to the IMU Secretariat in Zurich. The project of publishing the World Directory for the ICM-1958 appeared to have collapsed.

Yet the narrative of the first WDM, with all its ups and downs, had a happy ending, and it came with astonishing speed. After Stone had resigned and Hodge assumed only an interim chairmanship of the WDM Commission, the post of Chairman was offered to Chandrasekharan. He declined, but in a letter to President Hopf, he volunteered to complete the publication of the WDM in India, at the Tata Institute, in Bombay. The book would be based on Stone's lists with some improvements. After all the doubts and worries that had been expressed about the Directory, the tone of Chandrasekharan's letter was different. He explained point by point why he was convinced that all difficulties could be overcome. If he could receive all pertinent material by the end of February 1958, the project could be finished before the following August. Having been in correspondence with Mac Lane, a member of the IMU Executive Committee, Chandrasekharan could add that he was under the impression that Mac Lane supported his proposal [172].

In Zurich, Hopf and Eckmann rose to the situation. A quick calculation indicated that the two of them plus Chandrasekharan and Mac Lane constituted a majority of the Executive Committee. Instead of waiting for a reply from the other three, they decided to act immediately. The last part of the WDM material had left London on 3 February 1958 and arrived in Zurich just before Chandrasekharan's letter, dated February 11, was received. On 22 February 1958, all WDM material from Butterworths, in twelve boxes, was in Chandrasekharan's hands in Bombay, and he was authorized to proceed.

Chandrasekharan set to work immediately, assisted by his wife, three of his research assistants, and two secretaries lent by the Tata Institute. Many administrative problems had to be settled, and much checking and revising was still required. In addition to lists by geographical distribution, Chandrasekharan observed the earlier decision to produce an alphabetical list of all names. "I am working round the clock," Chandrasekharan wrote to Stone. Rapid progress was made, and on 15 March 1958 Chandrasekharan was able to tell Hopf that the master copy of the World Directory, in full, had been delivered to the printer. The sales price of the Directory, one dollar per copy, would be one-fifth of what Butterworths had envisaged [173]. Hopf had every reason to be relieved: "Again and again, I am bewildered by the speed of the progress of the W. D. and I cannot enough appreciate your energy and all your deliberate steps. To think that less than two months ago I was almost convinced that the W. D. would never see the light of this world!" [174].

The first edition of the *World Directory of Mathematicians*, "published under the auspices of the International Mathematical Union and with the co-operation of the Tata Institute of Fundamental Research," came out in the summer of 1958. At that time the Union had thirty-six member countries. Their lists were included in the book, except that there were no lists from the USSR and Czechoslovakia. In addition, there were names

from as many as twenty-seven nonmember countries [175]. Although the number of mathematicians from these countries was small, their inclusion represented an expansion of the Union's sphere.

At the General Assembly in August 1958, Hodge could announce that the task of the Commission had been accomplished. The Assembly resolved to discharge the Commission, expressing thanks to it, to the Tata Institute, and to Chandrasekharan. It requested the Executive Committee of the Union to take the necessary steps for future cooperation with the Bureau established at the Tata Institute for later editions of the Directory.

More specifically, the Bombay Bureau of the World Directory of Mathematicians was entrusted with the task of preparing a second edition, more complete than the first one, within a budget appropriation of $1,200. The ice had been broken, and no dramatic incidents were associated with the preparation of the second edition. It appeared, on schedule, in August 1961. The number of countries represented had risen to seventy-one, of which thirty-five were members of the Union. The price, $1.50 per copy, was up fifty percent from the price of the first edition, but so was the volume, 242 pages and 5,400 names as compared to 151 pages and 3,500 names in the first edition [176].

On a resolution of the Executive Committee of the IMU, a subcommittee consisting of Chandrasekharan, Hopf, and Morse was set up in October 1961 with a view to making recommendations regarding a possible third edition of the Directory. Since the response to the second edition had been positive, the Executive Committee decided to bring out a third edition ahead of the ICM-1966. Again, the Bureau of the WDM in Bombay was entrusted with the task, under the existing pattern of collaboration between the Union and the Tata Institute. At his opening address at the 1966 IMU General Assembly, President de Rham could announce that the third edition had just appeared. Containing for the first time a list of mathematicians of the Soviet Union, it was much more voluminous than the two previous editions. With well over 2,000 names, the USSR formed the largest national group after the United States. The total number of names exceeded 10,000, doubling the number of the previous edition. The price doubled as well, $3 per copy, and the number of pages, 488 [177].

The three first editions of the Directory were edited and printed in India under supervision of Chandrasekharan. In 1965 he had moved permanently to Zurich, and the question arose of how to proceed. At the meeting in Paris in 1968, the Executive Committee decided that a fourth edition of the WDM should be brought out, if possible, ahead of the International Congress of Mathematicians in 1970. Several offers for printing the Directory were then considered, and finally, the commercial company Almqvist & Wiksell, Uppsala, was entrusted with the publication [178].

With the decision to move the final editing and printing to Sweden, Otto Frostman, the Secretary of the IMU, became the new supervisor of the work. The fourth edition came out as planned in 1970, as did the fifth,

in 1974. The fifth edition was available for purchase during the Vancouver Congress at the special price of $10.00 per copy. The regular price was fixed at $12.50. The Directory now contained about 18,000 names [179].

In 1975, Frostman, whose term as Secretary had terminated and who had been ill, made it clear that he was not willing to bear the responsibility for the WDM after the appearance of the 1978 edition. This forced the Executive Committee to find a new solution. At its 1976 meeting, J.-L. Lions refused to assume "this fantastic amount of work," while M. Nagata, a member of the Executive Committee, volunteered to take over the publication in Japan [180].

Frostman died in December 1977, in the middle of his work. A difficult situation would have arisen had not his wife, Lisa Frostman, and his son helped in organizing the data. Nagata set to work in advance of the agreed timetable, and the Directory was completed at the University of Kyoto. It came out in 1979, with one year's delay [181].

The 1982 edition, also produced under the supervision of Nagata, was prepared and published by the American Mathematical Society. The Directory had different distributors for different continents: the Japanese company Kinokunya, Tokyo; the American Mathematical Society; and North-Holland Publishing Company, Amsterdam. This turned out to be a complicated arrangement, causing much work and worry for the Union's secretariat, which had overall control over sales. By a decision of the Executive Committee, the American Mathematical Society became the coeditor with the IMU and the exclusive distributor of the Directory from the 1986 edition on [182]. Since that time, the responsible editor and liaison between the Union and the American Mathematical Society has been the U.S. member of the IMU Executive Committee. They were G.D. Mostow for WDM '86, W. Feit for WDM '90, and D. Mumford for WDM '94.

From its beginnings up to the present day, the Directory has been well received. The problems caused by the increase in the number of names have been alleviated by developments in information technology. The task of collecting data is a truly worldwide operation, supervised locally by the National Committees for Mathematics in member countries and by other suitable organizations elsewhere. The admissibility criterion for the 1994 edition was having had two articles reviewed either in *Mathematical Reviews*, *Referativnyi Zhurnal*, or *Zentralblatt für Mathematik* over the last five years. Every National Committee had the privilege of adding a "discretionary supplement" of names, containing no more than five percent of the number of names eligible under the principal criterion [183]. The condition "over the last five years" for WDM 1994 was a new requirement. This criterion eliminated several nonmember countries from the Directory. In spite of the appearance of new countries following the disintegration of the Soviet Union, the number of countries was reduced from eighty-four in the 1990 edition to sixty-nine in 1994.

The 1994 Directory comprised 42,028 names of individual mathematicians. This was four times the number of the first "complete" edition of 1966. The United States (15,435) and Russia (5,329) made up half of them and the eight countries with more than 1,000 names—USA, Russia, Japan, Germany, France, U.K., Canada, and China—three quarters of the total [184].

6.4 Extension of Mathematical Activities

After the first General Assembly, a good part of the time and energy of the new IMU had necessarily been devoted to activities that only indirectly served the purpose of promoting mathematics in the world. During the first years, policies and routines were developed for the administration, a small reserve fund was established, and attempts were made to channel the work of the Commissions into appropriate directions. At the same time, membership expanded to encompass most countries of the world with mathematical research activity.

Conditions thus gradually improved for directly promoting mathematics through the cosponsorship of Colloquia. This form of activity is explicitly mentioned in the statutes of the Union. As related above, the very first steps for finding sponsorship for the Colloquia were taken before the IMU was even formally established. The first two Colloquia were arranged in 1953, and the 1954 General Assembly adopted formal rules for their organization. The foundation thus having been laid, the Colloquia soon became a chief preoccupation of the Union. The Union's contribution to a Colloquium was important. The value of its financial aid was accentuated at a time when many currencies were nonconvertible, and the IMU imprimatur often helped the local organizers to obtain additional support from the host country. In reporting on the activities of the Union between the General Assemblies of 1954 and 1958, President Hopf said emphatically, "The most important and gratifying activity of the Union has been the sponsoring of international symposia."

The Colloquia made it possible for the Union to prove its global character. In applying financial aid from UNESCO, Secretary Bompiani had emphasized that UNESCO's subvention would make it possible to hold Colloquia in different parts of the world. This is what now happened. In 1955 a Colloquium on the Algebraic Theory of Numbers took place in Tokyo, Japan, and in 1956 an International Colloquium on Zeta Functions was held in Bombay, India. Chandrasekharan later said that the two Symposia were landmarks in the scientific histories of those countries.

In addition to the three Symposia held in connection with the International Congress of Mathematicians, Amsterdam, 1954, the IMU sponsored six Colloquia in the years 1954–1957 [185].

The Colloquia were well received, but an even more important development for the IMU, the involvement with the ICMs (Chapter 7), was forthcoming. However, in 1957 this could not yet be known. The Union, which had had disappointments with its projects concerning bibliography and exchange, continued its efforts to find useful forms for its activities. A Trial Program called the IMU Lecturers was launched. The IMU lecturers were expected to be mathematicians from one country who would be invited to give a substantial series of lectures by an institution in another (and usually quite distant) country. The inviting institution must be located in a member country of the IMU. After consulting its National Committee for Mathematics, the inviting institution should submit a suitable application to the Secretariat of the IMU. Each IMU grant must be matched by at least an equal sum from other sources [186].

While waiting for the inauguration of this project during 1958–1959, the Executive Committee felt that IMU fellowships should enable young mathematicians to pursue studies and research in major mathematical centers [187]. The IMU Lecturers Trial Program was ultimately divided into two different programs—the Union Lectures, to be given by eminent mathematicians; and IMU Fellowships for young mathematicians, particularly from developing countries or from countries with currency difficulties.

The Commission on Exchange had organized, with the help of the Austrian Mathematical Society, an information service concerning mathematicians normally resident outside Europe who were planning to visit one or more European countries, and European mathematicians planning to travel in Europe but outside their own country. Publicity was given to this scheme in *Internationale Mathematische Nachrichten*, in the *Notices of the American Mathematical Society*, and elsewhere. In spite of these efforts, the Report of the Executive Committee of the Union to the National Adhering Organizations, covering the period 1 June 1956 to 31 May 1958, arrived at the following assessment: "The response to the scheme has been disappointing.... The conclusion appears to be that most mathematicians have sufficient contact with their colleagues in other countries to be able to make their own plans in advance" [188].

7

The IMU and International Congresses (1958–1962)

According to the Statutes, one of the objectives of the IMU is to assist and support International Congresses of Mathematicians. After a modest start in this direction in the years 1952–1958, there was significant development after the 1958 General Assembly. Mathematical programs of the ICMs became the responsibility of the Union. At the same time, the IMU was authorized to award Fields Medals. Formal rules were ratified by the 1962 General Assembly in Sweden. These events are milestones in the history of the Union.

7.1 The 1958 General Assembly in Scotland

The third General Assembly of the IMU took place at St. Salvator's College, in St. Andrews, Scotland, 11–13 August 1958, immediately before the International Congress of Mathematicians in Edinburgh. The meetings of the two previous General Assemblies had been held in large cities, in Rome and the Hague. In 1958, the ambiance was different, that of a small Scottish town. Most people probably associate St. Andrews with golf, while the academic world associates the town with its University. Founded in 1411, the University is the third oldest in Britain, after Oxford and Cambridge. In this venerable institution the Assembly convened. The agenda followed the pattern that had developed at the two previous meetings of the Assembly.

The meeting was attended by the delegates of twenty-nine countries. In all, the Union had thirty-six members at the time of the Assembly.

Except for Egypt and South Africa, all countries that had been in the old IMU in 1932 had now rejoined the Union. With twenty-three members, Europe still dominated. The Americas had seven and Asia five. Australia was a member, but there was yet not a single country from Africa. (See the Appendix, Section 1.)

The central event of the St. Andrews meeting was that the first step was taken towards cooperation between the IMU and the Organizing Committees of International Congresses of Mathematicians. The discussion of how the IMU became a partner of the ICMs is postponed to Section 7.4, which is wholly devoted to this topic.

As told in Section 6.4, the President in his report on the activities of the Union emphasized the importance of the sponsoring of international symposia. Hopf concluded his report with the following words: "It more and more becomes clear that the Union is the one place where mathematics all over the world can be united. There have been gratifying activities of the Union during the last four years, but many a wish has not yet been fulfilled. In order to accomplish this task, the Union and its Executive Committee need the response and the active cooperation of all member countries and their adhering organizations."

As in Rome and the Hague, the questions regarding mathematical publications gave rise to much discussion. The Chairman of the Commission for Scientific Publications, Ralph Boas, reported that among the various projects envisaged by the Commission, none had so far led to a concrete result, although some of them had had some influence on publications brought out by publishing firms. It appeared from the discussion that the various tasks should be separated, in particular, that the problems of documentation be given to a new Commission. For this purpose, the Assembly established the Commission on Documentation of Mathematical Literature. As for other problems of publication, the Assembly resolved that the Commission for Scientific Publications be maintained.

The IMU Lecturership Program, which was described in Section 6.4, met with general approval. The Assembly resolved that this activity should continue.

In discussing the activities of ICMI, the Assembly made the important decision that adherence to ICMI should not be restricted to the members of the IMU. In other words, countries could be associated with ICMI even though their research activity had not yet reached a level to warrant membership in the Union. (Activities of ICMI, as a subcommission of the IMU, are surveyed in Section 11.2.)

In the first years of its existence, the IMU did not use the income from membership dues for scientific purposes. The aim was to establish a reserve fund of at least $7,000, to be used for later mathematical activities. In 1957, it was felt that a sufficiently large reserve fund had been collected. Thus the Assembly resolved that "the Union can now be concerned primarily with the spending of money on scientific programmes."

In spite of this resolution, the unit contribution of $65.20 adopted by the 1952 General Assembly was not raised, although it had lost about ten percent of its real value owing to inflation. The slightly augmented income from the dues resulting from increased membership would not suffice for the expanded activities of the Union.

The budget, with a total expenditure of $6,070 per year, was not in accord with the resolution that the Union's money could be spent primarily on scientific programs. It was decided that contributions towards the scientific activities of the IMU could be taken from "Contingencies," for which the tiny sum of $850 had been put aside, or "from any amount unspent under the other items," which were all rather modest amounts for various administrative purposes. As before, mathematical activities were dependent on contributions from ICSU and UNESCO. (Cf. Section 11.1 and the Appendix, Section 12.)

The General Assembly approved amendments to the statutes. Three of them concerned the Executive Committee. Instead of the First and Second Vice-Presidents as before, there were to be two Vice-Presidents. The number of Members (in addition to the four officers) was increased from three to five. This was considered necessary in view of the growth of the Union. The retiring President became an ex officio member without a vote, in order to ensure continuity. As related before, Russian became an official language of the Union.

The composition of the Executive Committee elected for the four years 1959–1962 was as follows:

President: R. Nevanlinna (Finland)

Vice-Presidents: P.S. Aleksandrov (USSR) and M. Morse (USA)

Secretary: B. Eckmann (Switzerland)

Members: K. Chandrasekharan (India), C. Choquet (France), H. Kneser (Germany), J.F. Koksma (the Netherlands), K. Kuratowski (Poland)

Retiring President: H. Hopf (Switzerland), ex officio

The new President Nevanlinna (Fig. 7.1), from Helsinki, had, like Eckmann and Hopf, an affiliation with Zurich as well, where he was staying part of the year as an honorary professor at the University.

The Assembly elected M.H. Stone (USA) President of ICMI, S. Mac Lane (USA) Chairman of the Commission on the Exchange of Mathematicians, and J.F. Koksma (the Netherlands) Chairman of the Commission on Documentation of Mathematical Literature [189].

FIGURE 7.1. Rolf Nevanlinna (1895–1980). Finnish mathematician (complex analysis). President of the IMU 1959–1962. Chairman of the Fields Medal Committee for the Stockholm Congress 1962. Chairman of the Consultative Committee for the Moscow Congress 1966. President of the Stockholm Congress 1962. Honorary President of the Helsinki Congress 1978. (Photo: Studio Kuvasiskot 1958.)

7.2 ICM-1958 in Edinburgh

The 1958 International Congress of Mathematicians was held in Edinburgh on 14–21 August. W.V.D. Hodge was Chairman of the local Executive Committee and was elected President of the Congress. The mathematical program was planned and decided on by the Sub-Committee for Scientific Programme, all of whose members were British. At this Congress the IMU played no role except for its financial subvention for organizational expenses, travel grants, and publication of the Proceedings. The Fields Medal Committee was international and was chaired by the Union's President Hopf, but all its members were appointed by the British Organizing Committee.

The Congress was attended by 1,658 full members and 757 associate members. The total number, 2,415, was the largest for any International Congress of Mathematicians so far, though the number of full members was slightly less than at Harvard (around 1,700) in 1950. Of the mathematicians, about 500 were from the United Kingdom, 360 from the USA, 155 from France, 150 from Germany, 55 from Italy, 35 from the USSR.

Hodge's address at the inaugural session dealt with the question of why large ICMs should be arranged; it will be discussed in the following section, which is devoted to this theme.

In his capacity as Chairman of the Fields Medal Committee, Hopf introduced the winners: "A task which is particularly fundamental is to solve old problems; and another, no less fundamental, is to open the way to new developments. Our Committee is glad to have found two young mathematicians who have done unusually good work, one in each of these directions." He then announced that the Committee had decided to award the Medals to Klaus Friedrich Roth, of the University of London, for solving a famous problem in number theory, namely, the determination of the exact exponent in the Thue–Siegel inequality; and to René Thom, University of Strasbourg, for creating the theory of "Cobordism," which within the few years of its existence had led to the most penetrating insight into the topology of differentiable manifolds.

Hopf then presented the work of Thom in more detail, and H. Davenport spoke of the work of Roth. Heretofore, the chairmen of the Fields Medal Committees—Carathéodory in 1936, Bohr in 1950, and Weyl in 1954—had presented the work of both recipients to the Congress. Since 1958, the presentation of each medalist's work has been entrusted to a specialist in the field.

At the closing session it is customary to hear the invitation to the next Congress. In Edinburgh, an announcement of the host of the ICM-1962 could not be made because the Site Committee had not yet made its final decision. What had happened will be told in Section 7.4. (See also [190].)

7.3 Why Organize Large ICMs?

The first postwar International Congress of Mathematicians, at Harvard in 1950, was more than twice the size of the ICM-1936. At his opening address, the President of the Harvard Congress, Oswald Veblen, had called attention to this fact:

> I have referred to the political difficulties which have harassed this Congress, but think that if there are to be future international congresses, an even more serious difficulty will be the vast number of people who have formal, and even an actual, reason for attending. This makes all meetings, even for very

> specialized purposes, altogether too large and unwieldy to accomplish their purposes.... The Organizing Committee of the present Congress has tried to meet this problem by means of a series of conferences, more informal than the regular program, but even in conferences the problem of numbers will remain. It is to be hoped that our colleagues who have been meeting in New York to consider organizing an International Mathematical Union will have something to say to us on this and other problems before this Congress adjourns.

This rather pessimistic view of the future of the ICMs was slightly balanced by Veblen's general statement: "The solution will not be to give up international meetings and organizations altogether, for there is a deep human instinct that brings them about" [102].

Four years later, the President of the 1954 Amsterdam Congress, J.A. Schouten, treated the same question in his presidential address:

> I wish to draw your attention to a fact which was perhaps not so clear four years ago, but which is absolutely clear now: the place of mathematics in the world has changed entirely after the second war. Before, mathematics had an honourable place among the sciences because of its central position, its history, and its traditions, but there were in those times not many mathematicians, and most people had only some bad memories from their school years and the comforting idea that in real life they would meet mathematics never more.... During and after the war it became obvious to every one that nearly all branches of modern society in war and in peace need a lot of mathematics of all kinds, from the simplest school arithmetics up to the highest developed theoretical parts.... This is all very satisfying, and we could be content that our science got so prominent a place in the structure of modern society. But some difficulties arise.

Having referred to the rising numbers of participants at the ICMs before and after the war, Schouten continued:

> On the one hand we may be happy with this progress, but on the other hand it is wise not to shut the eyes for the fact already pointed out by Professor Veblen in his opening address at Cambridge, that there is a limit to Congresses of this kind. This limit will perhaps be reached very soon if the number of mathematicians goes on increasing as rapidly as it does now and if in the future, as I fervently hope, big countries with a great number of good mathematicians will break with the system of sending a very small delegation, the extent of which is in no way proportional to the mathematical importance of the country involved.

(This side step from the main theme was an implicit reference to the Soviet Union, with only five participants at the Congress.)

> But if the number of participants increases, the question arises: shall we have in future one big congress or instead several smaller meetings on definite topics. In the years after the war we have already had several very small meetings called colloquia, and so far as I can see they were a great success. But what I mean here is a splitting up of a big congress into a small number of parts to be held separately but with one central organization. Personally, I think that the mutual induction of the several branches of mathematics is so very important that we should try as long as possible to save the idea of one big congress. But, if from purely technical considerations such a congress would become impossible, the splitting up should be done very carefully and with an open eye for the structure of the science of mathematics as a whole.

At the closing session of the Amsterdam Congress, Hodge, after issuing the invitation to the 1958 Congress in Edinburgh, added:

> The steadily increasing size of our Congresses has caused some people to wonder whether they are in fact becoming too big, and in danger of getting out of control.... I shall express my personal conviction that the purpose of international congresses and of specialised colloquia are quite different, and that there is a real danger that if the complexities and cost of organisation continue to increase, it will become more and more difficult to find countries able and willing to undertake the burden of arranging a congress, and eventually there might only be one or two of the few remaining rich countries able to do so. There can be no doubt that this would be very bad for mathematics [145].

In Edinburgh, Hodge returned to this theme in his presidential address. His analysis of the objectives of the ICMs is worth quoting extensively:

> At the Harvard Congress of 1950 Professor Veblen referred to the difficulties encountered by the organizers of International Congresses, caused by the ever increasing number of people professionally engaged in the study of mathematics, and in Amsterdam in 1954 Professor Schouten spoke of the same problem. As you can well imagine, the organizers of the present Congress have had to face this problem once again.
>
> The International Congresses of Mathematicians, which are held every four years, serve a number of purposes. The most important is to get together the leaders in all branches of mathematics so that they may discuss their common problems and

exchange ideas on them. In saying this, I wish to emphasize the phrase "all branches of mathematics." In recent years there has been a steady growth in the number of symposia held, many with the support of the International Mathematical Union. In advancing research in special fields, these symposia have done excellent work. But this is not enough. It is essential for the well-being of mathematics that there should be periodic gatherings attended by representatives of all branches of the subject, and this for several reasons: in my personal opinion, the most important reason is that gatherings such as this serve as an invaluable safeguard against the dangers of excessive specialization.

The problem of specialization is a difficult one. Mathematics is now so vast that few can hope to cover the whole range, and much of our progress has been due to the efforts of men and women who have devoted their lives to work in a narrow field of research. Most of us must continue to work in specialized fields, and with good fortune we can make our contribution to mathematics as a whole in this way. But there are dangers in this. There is always the risk that we may come to regard our own special problems as all-important; and to regard mathematics simply as a system of conclusions drawn from definitions and postulates that must be consistent, but otherwise may be created at the free will of the mathematician. As Professor Courant has justly remarked: "If this description were accurate, mathematics could not attract any intelligent person. It would be a game of definitions, rules, and syllogisms without motive or goal.... Only under the discipline of responsibility to the organic whole, only guided by intrinsic necessity, can the free mind achieve results of scientific value."

Over-specialization also produces a practical difficulty. As we all know from our own experience, in order to make progress in our own field we must know what is going on in other fields, and what new techniques are being developed elsewhere in mathematics. The problem we are faced with is simply that of maintaining contact with all the main developments going on in mathematics while working intensively in our own specialized field. Some solution of this problem is essential, and International Congresses can go a long way towards giving the required answer. These Congresses provide an opportunity for periodic stocktaking, and the opportunities they provide for surveying the whole field of mathematics are a way of counteracting the evils of excessive specialization, and of determining the "intrinsic necessity" to which Professor Courant refers: they may thus vitally influence the whole course of mathematics in the succeeding years [191].

The fears of the Presidents of the ICMs 1950, 1954, and 1958 that the Congresses would grow unmanageable have not materialized, at least not by the 1990s. In light of the very rapid increase in the number of professional mathematicians, this could well have happened. In 1958, the *World Directory of Mathematicians* admitted around 3,500 names (to which mathematicians from the USSR and some other Socialist countries should be added). In 1994 the number was over 40,000. However, the Congresses seem to possess some mechanism of self-preservation that limits their growth. From the 1950s to the 1990s, participation in the ICMs has only doubled, and it appears to have reached a rather constant level. Of course, the problems of organizing a gathering of three to four thousand mathematicians are formidable, but they are not insurmountable. So far, there have always been countries willing to host a Congress. Local arrangements associated with an ICM are treated in some depth in connection with the 1978 Congress in Helsinki (Section 9.4).

7.4 The IMU Becomes a Partner of the ICMs

Throughout its existence, the IMU has believed that it should be connected with the International Congresses of Mathematicians. According to the first statutes adopted in 1920, the Union was to provide for the organization of the International Congresses. The fateful separation of the IMU from the Congresses in 1928 was described in Section 2.4. When preparations began in the late 1940s to re-create the IMU, it was taken for granted that the ICMs should be explicitly mentioned in the statutes. In all versions of the statutes, from the first draft to the present one, the objectives of the Union are listed as follows: "(a) to promote international cooperation in mathematics," and right after that, "(b) to support and assist the International Congress of Mathematicians."

At the 1954 and 1958 Congresses, the role of the Union had been modest. In Amsterdam in 1954, a joint Committee of the Union and the Organizing Committee of the Congress was appointed to make recommendations regarding the site of the 1958 Congress. At the same time it was decided that a Committee consisting of three representatives of the IMU and two of the Organizing Committee of the ICM-1958 should make the proposal of the location of the 1962 Congress. This practice was reconfirmed for the ICM-1966 in 1958 at the closing session of the Edinburgh Congress.

The parity between the Union and the Congress was broken in 1962. It was then decided that the IMU should set up this Committee, which is complemented by two members appointed by the Organizing Committee of the previous Congress. The name "IMU Site Committee" came into use. Gradually, the Site Committee became almost identical with the Executive Committee. Since 1983 it has consisted of the members of the Executive

Committee plus one representative from the Organizing Committee of the previous Congress. The Site Committee has even been fully identical with the Executive Committee if one of the latter's members has happened to be from the host country of the previous Congress. This arrangement facilitates scrutinizing the invitations in time, since the Executive Committee meets every year and twice in the year of the Congress. The problem that occurred in 1958, soon to be unfolded, has not repeated itself.

The recommendation of the Site Committee is confirmed by the General Assembly. The Congress still has the ceremonial role of accepting by acclamation at the closing session the invitation to the next Congress (whose location by that time has been de facto decided by the Site Committee and de jure by the General Assembly). Subsequent developments have shown that it is important to formalize the decision making. As will be seen, it has not always been easy to choose the winner among competing invitations.

Important as it was to move the power to decide on the location of the ICMs to the Union, another even much more significant development began in 1958. Eventually, all responsibility for the mathematical program of the ICMs was transferred to the Union. In 1958 President Hopf was determined that this should happen.

In the summer of 1958, before the General Assembly, Hopf had written that it was the intention of the Union to offer its services in the organization of the scientific program of the ICMs [192]. In his opening address to the St. Andrews General Assembly, Hopf repeated this view: "The cooperation of IMU with the Organizing Committees of International Congresses of Mathematicians has been so far restricted to financial support. It is expected that in the future this cooperation will also be extended to the scientific preparation."

In saying this, Hopf's expectation was still in good part wishful thinking. Cooperation would have meant such a fundamental change in time-honored practice that it could not be thought of without the consent of the Congress organizers. At the beginning of the General Assembly, the host of the next Congress is usually known, and preliminary discussions could have been carried out. However, in 1958 this was not the case.

Hopf's remarks about the role of the IMU in the scientific preparation of the Congresses came under discussion when the point of the agenda was reached entitled "IMU and future International Congresses of Mathematicians." The U.S. National Committee had suggested that the General Assembly discuss the renovation of the style of the Congresses. Two questions were posed: (a) Are the International Congresses of Mathematicians useful? and (b) Since the size of the Congress has become bigger and bigger, is it necessary to change its general style and the arrangement of the scientific program? The answer given by the General Assembly to the first question was definitely in the affirmative. As for the second, the general opinion was that despite certain difficulties, the tradition should continue. General survey talks on recent development in the various fields of math-

ematics should constitute an important part of the program, in addition to half-hour research lectures. Short communications should also be maintained in the program.

In view of these opinions, President Hopf proposed that the IMU offer to future Congress organizers not only financial assistance, but also participation in the preparation of the mathematical program. It would be up to the scientific bodies of the inviting countries of future Congresses whether or not they wished to avail themselves of this cooperation. This explicit proposal was endorsed by the General Assembly, which put on record that cooperation between the IMU and the International Congresses of Mathematicians would be useful for the development of mathematics [189].

Respecting the long traditions of the International Congresses, the IMU thus offered its aid on a "take it or leave it" basis. Yet the appeal to the local organizers was strong. The Union seemed to expect a positive reaction.

The Site Committee to consider the location of the 1962 International Congress had been appointed at the closing session of the Amsterdam Congress in 1954. It consisted of three representatives of the IMU, Hopf, Chandrasekharan and Mac Lane; and two of the organizers of the 1958 Congress, Hodge and Smithies. This time, several countries had expressed an interest in hosting the 1962 International Congress. In spite of this multiplicity of choice, the Site Committee found it difficult to find a satisfactory solution. During the Edinburgh Congress contact was made with delegates from Sweden (which had not made a bid for the ICM-1962) with the proposal that they host the next Congress. The four Swedes with whom discussions were carried out in Edinburgh were O. Frostman, L. Gårding, L. Hörmander, and Å. Pleijel. They were not quite unanimous. Frostman and Pleijel, the two Swedish delegates of the St. Andrews General Assembly, liked the idea, whereas Gårding and Hörmander were skeptical. Caught by surprise, the Swedes were unable to give a definitive answer. Yet Frostman and Pleijel showed so much interest that Hodge, the Chairman of the Site Committee, received the impression that a positive response was forthcoming [193].

This feeling of Hodge determined the way he presented the case of the next Congress at the closing session of the Edinburgh Congress. He admitted that it was not possible to make any announcement yet of the name of the host country for 1962, but he continued by saying, "The prospects of holding a Congress in that year amount to a certainty. One country represented here is very anxious to be our host but is unable to issue a formal invitation until certain consultations are completed at home; while another country has generously expressed its willingness to await the conclusion of these consultations and has promised to issue an invitation if, but only if, the first country finds itself unable to do so" [194].

Right after Edinburgh, the Swedes held discussions to determine how to respond to the request of the Site Committee. After some financial requirements of a possible Congress had been established, with a guarantee from the state and a promise of a cash allocation from the Swedish Society of

Life Insurance Companies, an affirmative response was given to the IMU. The following announcement can be read from the Proceedings of the ICM-1962: "At a session on 28 October 1958 the Swedish National Committee for Mathematics decided to accept the invitation, conveyed by the International Mathematical Union, to organize the next International Congress of Mathematicians in Stockholm in 1962." This decision was later endorsed by the Swedish Mathematical Society, and a joint invitation was issued to the mathematicians of the world [195].

Before deciding to organize the Congress, Swedish mathematicians had arrived at the remarkable conclusion that for planning the mathematical program it would be advisable to work together with the IMU. Lennart Carleson seems to have regarded cooperation with the IMU as a necessary condition for Swedish acceptance. Hörmander remembers having said, "Apart from Analysis, we need assistance from the Union." Soon the decision was made in Sweden to ask the Union's assistance in setting up the mathematical program, and a letter to this effect was sent to Zurich to the IMU [193].

In consequence, on 10–11 December 1958, at the meeting of the IMU Executive Committee in Lausanne, it was resolved that the IMU would give the Swedish National Committee for Mathematics and the Swedish Mathematical Society all the help they might need in organizing the Congress. There was no clear picture yet of how to do this, but the discussions led to the decision that "IMU will later on establish a body with a task to help the organizers of the Congress prepare the scientific program and all practical questions." Hopf and Morse were appointed as liaison officers, their task being to submit concrete propositions for cooperation between the IMU and the Congress [196].

After December 1958, the documents tell nothing of contacts between the IMU and the Congress organizers for almost two years. In September 1960, the cooperation was made formal on the part of the Union. At Hopf's request, Chandrasekharan drafted a detailed plan of how the collaboration should be implemented. This was a remarkable document. Apart from some details, the planning of the mathematical program of the ICMs has thereafter rested on Chandrasekharan's architecture of 1960.

The main point of Chandrasekharan's proposal was articulated right at the beginning: "A Consultative Committee of the Stockholm Congress should be set up, which would be in charge of the entire scientific programme of the Congress. The membership should not exceed nine, four Swedish members and five others." This was the concrete step to make the IMU a partner of the ICM.

Another important point concerned the working mode of the Consultative Committee, which was to be assisted by a large number of advisors. More precisely, the Committee should appoint international panels for eight sections of mathematics (the same number as in Edinburgh). A large part of Chandrasekharan's plan consisted of detailed instructions for the elec-

tion and composition of the panels and how the panels should work and make their proposals to the Consultative Committee.

Finally, the IMU was connected with the Fields Medals: "The Consultative Committee should forthwith appoint a Committee for the Fields Medals" [197].

Rapid progress was now made. The "liaison officers" Hopf and Morse accepted Chandrasekharan's plan (with minor changes). At a joint IMU–Congress meeting, held in Zurich in November 1960, agreement was reached on how to proceed. A list of the members of the Consultative Committee was produced. A few weeks later the Union's Secretary Eckmann sent a letter to the members of the Executive Committee [198]:

> According to the desire expressed by the Congress Organizers and in full agreement with them, Professors Hopf and Morse now present to our EC the proposition to establish a Consultative Committee to the Congress 1962 as follows. This Committee, denoted by CC, will prepare the entire scientific program of the Congress and submit it to the Organizing Committee for final decision. The CC consists of the following members of our EC: Hopf, the two Vice-Presidents Morse and Aleksandrov, the present and the future Secretary Eckmann and Chandrasekharan; further of the following members from Sweden: Carleson, Frostman, Gårding, Hörmander, Pleijel; and the following additional members: Hodge, Montgomery, and de Rham as Chairman of the CC.

This was larger than the Committee envisaged by Chandrasekharan, who was not satisfied with the change. Neither did he like the added clause that the Consultative Committee, after due consultation with the local organizers, had to submit every scientific decision again for their approval. (On both points, the 1962 General Assembly made a full return to the original Chandrasekharan model.)

Overall control of the Swedish Organizing Committee had practical consequences. When the USSR wished to modify and enlarge the list of Soviet invited speakers, it fell to the Swedes to defend the decisions of the Consultative Committee [199].

The Consultative Committee was larger on paper than in reality, due to the decision that not all members need be present at meetings. Frostman and Pleijel, who were in charge of the Swedish Organizing Committee, called themselves "deputies"; the active Swedes on the Consultative Committee were Carleson, Gårding, and Hörmander. Only these three are mentioned in the Proceedings of the Stockholm Congress as "the Swedish representatives in charge of the scientific programme."

Formal confirmation regarding the Consultative Committee was made at the meeting of the Executive Committee of the IMU in Düsseldorf, Germany, in January 1961. The Consultative Committee had its first meeting

in Düsseldorf immediately after the EC meeting. The new role of the IMU did not affect participation in the Congresses. It was taken for granted that they should remain open to all mathematicians of the world, not only to those from a member country of the IMU.

The Executive Committee of the IMU had good control of the Consultative Committee: Of the eight members appointed by the IMU, five were from the Executive Committee. Besides, Hodge had recently served on the Executive Committee, and at that time, de Rham was the Executive Committee's candidate for President or Vice-President of the Union. Soon, the policy of the Executive Committee changed. The only member of the Executive Committee to serve on the Consultative Committee for the 1966 Congress was Past President Nevanlinna. After that, the IMU has not elected members of the Executive Committee to the Consultative Committee. Shunning the image of a central bureau that determines what is and what is not good mathematics, the Union decentralizes decision making in evaluating mathematics in connection with the ICMs.

At the Düsseldorf meeting another important step was taken when the Executive Committee accepted the following resolution [200]: "In pursuance of the expressed desire of the Organizing Committee of the Stockholm Congress 1962, and in accordance with the suggestions made by the late Professor Fields, the EC expresses its willingness to take over the arrangements of the award of the Fields Medals at successive International Congresses."

As described in Section 3.1, Fields had written in 1931 that as things stood at the time, a practicable course of procedure would seem to be for the Executive Committee of the Congress to appoint a small international Committee. Later, the role of the Congress might be taken over by the Executive of the IMU when that organization had been generally accepted. In 1931, the IMU was not "generally accepted," but three decades later it was.

For the ICM-1962, the local organizers still had a say about the composition of the Fields Medal Committee through the Consultative Committee. After that, all arrangements concerning the award of the Fields Medals have been in the hands of the IMU.

The decision to set up a joint IMU-Congress Consultative Committee for the scientific program was an event of paramount importance, both for the Union and for the Congresses. The transition from the old practice, when the local host had had total responsibility for the Congress, was smooth. In the case of ICM-1962, it was up to the host country to decide whether or not to accept cooperation with the IMU. The Swedes gave an affirmative answer to this question, which the IMU had posed explicitly. In so doing they did a great service for the world mathematical community. The host country had good representation in the Consultative Committee, and this practice was followed in the three following ICMs.

7.5 The 1962 General Assembly in Sweden

Less than a year before the 1962 General Assembly there was a new Secretary of the IMU. In 1961, after Eckmann had announced his wish to resign as Secretary, the Executive Committee appointed K. Chandrasekharan, Bombay, as Secretary for the unexpired term of the present Secretary. The Executive Committee decided that Eckmann would continue as a member of the Executive Committee during this period.

The legal domicile of the Union thus became Bombay, and the Secretary's Office was transferred to the Tata Institute of Fundamental Research. However, the Business Office of the IMU remained in Zurich [201].

More often than not, the IMU was lucky to have a competent, conscientious person in the office to assist the Secretary. Such work of the Union was often intentionally kept invisible. Emphasizing its scientific character, the IMU, while admitting that administrative affairs are unavoidable, did not wish them to play too prominent a role at the meetings of the Executive Committee and the General Assembly.

The fourth (postwar) General Assembly of the International Mathematical Union met at Saltsjöbaden, Sweden, on 11–13 August 1962. Saltsjöbaden is a popular tourist resort near Stockholm. The venue of the meeting was the Grand Hotel, where the delegates were also accommodated, either in the hotel proper or in its summer annex. There were seventy-six delegates representing thirty-one of the thirty-seven member countries of the Union.

In opening the meeting and reviewing the work of the Union since the General Assembly at St. Andrews in 1958, President Nevanlinna found that "it would be correct to say that the Union is now more firmly established, and that its work, although modest, has been definitely fruitful." He then discussed the new cooperation between the IMU and the Congress. "As in the past, we have agreed to give financial support to the Congress, to the extent of $15,000. But for the first time, the scientific program is based to a large extent, if not entirely, on the recommendations of a Consultative Committee formed jointly by the International Mathematical Union and the Swedish Organizing Committee. A definite procedure has been established by the Union for the appointment of the Fields Medal Committee and for the appointment of the Committee to recommend the location of future Congresses. This will have become, in the coming years, an established tradition."

Nevanlinna had touched the central theme. As in St. Andrews four years earlier, the meeting of the General Assembly was dominated by discussions and resolutions concerning the International Congresses of Mathematicians. The consensus in favor of organizing such congresses, once every four years, was again recorded. But the important development was that the role of the Union was now definitively established. According to the official report of the General Assembly, "there was general agreement that the pattern

of collaboration that had evolved, and become established, between the Organizing Committee of the Congress and the Executive Committee of the Union, should be continued in all future Congresses."

These points of agreement were documented as follows:

1. The Fields Medal Committee is appointed by the Union, their decision is communicated to the Secretary of the Union, who will obtain the medals from Canada, and only the arrangements for the actual presentation are looked after by the Organizing Committee of the Congress.

2. The scientific program of the Congress (especially the invited one-hour and half-hour lectures) is decided upon by a Committee appointed by the Union, with 4 representatives of the Organizing Committee of the Congress, 4 representatives of the Executive Committee of the Union, and, in addition, a Chairman appointed by the President of the Union.

3. The recommendation for the location of the 1970 Congress is made by a Committee appointed by the Union and having on it at least two representatives of the Organizing Committee of the 1966 Congress.

The General Assembly signified its approval of these points, without dissent [202].

This was a remarkable formalization of the new role of the IMU at the ICMs. A large step had been taken in four years, since President Hopf had expressed the wish at the opening of the 1958 General Assembly that the contribution of the Union to the ICMs should be more than just financial support. The position of the Union regarding Fields Medals, the scientific program, and the site of the Congress was clearly defined and made permanent in Saltsjöbaden in 1962 (Fig. 7.2).

The stipulation that the proposition of the Consultative Committee had to be submitted to the Organizing Committee of the Congress for final decision was not included in the resolution adopted in Saltsjöbaden. After 1962, the Consultative Committee no longer had the character of an advisory body; it made final decisions. It could well have been called the "Program Committee" already then. This name was later adopted, but with much delay: ICM-1986 was the first Congress with a Program Committee.

After the Stockholm Congress, the option was no longer offered to the host countries of the ICMs whether to work alone or in collaboration with the IMU in the preparation of the mathematical program. The resolution adopted by the IMU General Assembly in 1962 made the IMU a permanent partner of the Congresses.

Detailed printed reports of seven IMU-sponsored mathematical conferences that had taken place after the 1958 General Assembly were circulated. In view of the success attained by all these colloquia, it was decided to continue the program as hitherto.

FOURTH GENERAL ASSEMBLY OF THE INTERNATIONAL MATHEMATICAL UNION

Saltsjöbaden (Sweden), August 11—13, 1962
(Grand Hotel Saltsjöbaden, 10 A. M.)

AGENDA

1. Opening of the Assembly
2. President's Report on the activities of the Union
3. Appointment of Committees
   (i) Nominating Committee, (ii) Budget Committee, (iii) Committee on Resolutions, (iv) Steering Committee for the sessions on ICSU-ICMI-SCOTS, (v) Tellers
4. Commissions of the Union: reports and plans for future activities
   (a) ICMI (SCOTS)
   (b) Exchange Commission, IMU Lecturership Programme
   (c) Commission for Documentation of Mathematical Literature and for Scientific Publications
5. Symposia: reports
6. Financial Report for 1958—1962; budget estimates for 1963—1966; raising of membership dues
7. Relations with ICSU-UNESCO
8. IMU and the International Congress of Mathematicians
9. Change of Group of Adherence
10. Elections:
    (a) Executive Committee
    (b) Commissions
11. Resolution adopting reports
12. Next meeting of the General Assembly
13. Any other item with the permission of the President.

ICSU = International Council of Scientific Unions
ICMI = International Commission on Mathematical Instruction
SCOTS = Special Committee on the Teaching of Science.

FIGURE 7.2. Typical agenda of an IMU General Assembly. The resolutions related to item 8 were of decisive importance.

The Budget Committee recommended, and after some discussion the General Assembly approved, an increase of the unit subscription by fifty percent from 1 January 1963. The new unit was equivalent to $97.80 (corresponding to 300 gold francs). For the first time, the expenditure was divided into two parts. Schedule A for administrative expenses totaled $6,450, and schedule B for mathematical activities $4,000. No appropriation from schedule B was allowed to augment the provision made in schedule A. This structure, adopted in Saltsjöbaden, is still in force. The considerable increase in dues was needed to compensate for inflation and reduced support from outside sources. In fact, the total expenditure in the years 1963–1966 was not much higher than before. (Cf. the Appendix, Section 12.)

The Commission for Documentation of Mathematical Literature and for Scientific Publications was discontinued. This sort of work had been carried out by the Union in various forms since the Rome General Assembly of 1952 but never with particular success. Now it was ended, except that one more attempt was made four years later.

The following Executive Committee was elected for the four-year period beginning 1 January 1963:

President: G. de Rham (Switzerland)

Vice-Presidents: H. Cartan (France), K. Kuratowski (Poland)

Secretary: K. Chandrasekharan (India)

Members: J.C. Burkill (U.K.), F. Hirzebruch (Germany), M.A. Lavrentiev (USSR), D. Montgomery (USA), B. Segre (Italy)

Past President: R. Nevanlinna (Finland), ex officio

The appointment of de Rham (Fig. 7.3), of the University of Lausanne, meant again a Swiss affiliation for the Union. Yet neither of the two previous Presidents, Hopf or Nevanlinna, were native Swiss, Nevanlinna not even a resident in Switzerland. Morse had tossed off the idea that Vinogradov might be a presidential candidate. In the Executive Committee this suggestion caused more consternation than understanding [203].

A. Lichnerowicz was elected President of ICMI and B. Eckmann Chairman of the Exchange Commission.

7.6 ICM-1962 in Stockholm: An IMU Breakthrough

The International Congress of Mathematicians 1962 met in Stockholm during 15–22 August 1962, under the patronage of His Majesty the King of Sweden. The Congress in Sweden had a long prehistory. As early as 1908

FIGURE 7.3. Georges de Rham (1903–1990). Swiss differential geometer. President of the IMU 1963–1966. Chairman of the Consultative Committee for the Stockholm Congress 1962. Chairman ex officio of the Fields Medal Committee for the Moscow Congress 1966.

Mittag-Leffler had expressed the wish that an ICM be held in Stockholm in the near future. His formal invitation to hold the Congress in Stockholm in 1916 was accepted by the ICM-1912. World War I not only made the Congress in 1916 impossible but nullified the decision for holding the next ICM in Stockholm, in spite of Mittag-Leffler's protests (Sections 2.1 and 2.4). Mittag-Leffler's death in 1927 put an end to Swedish interest in hosting an ICM. When the Stockholm Congress finally did take place, the IMU had to persuade the Swedes to issue an invitation (Section 7.4).

The Congress Headquarters were located at the Royal Institute of Technology, where most of the lectures were also given. The Congress was attended by 2,107 ordinary and 987 associate members. These figures both separately and combined exceeded those for any of the previous ICMs.

In his welcoming address at the opening session, O. Frostman, Chairman of the Organizing Committee, explained the role of the IMU to the Congress:

> To be able to present a scientific programme worthy of an international congress it was... decided at an early stage to seek the assistance of the International Mathematical Union, and at a meeting in Zurich in November 1960 a small Consultative Committee was appointed with Professor de Rham, Lausanne, as chairman. The wide experience and knowledge represented in the Consultative Committee itself and strengthened by contacts with experts from all over the world made it possible to choose the subjects and speakers for the one-hour addresses and to appoint chairmen of the international panels which have proposed the half-hour speakers. At subsequent meetings the Consultative Committee brought the information gathered to the Swedish representatives, and all decisions were made in agreement. It must be clearly stated that the Swedish Committee takes the full responsibility for the organization of the congress, but without the invaluable help of the panels and the Consultative Committee the scientific programme would not have been adequate.

The choice of the President of the Congress further emphasized the Union's breakthrough. Frostman continued:

> The part performed by the International Mathematical Union in preparing the scientific programme of the congress is a leading one and is well suited to act as a precedent for any future international congress. It seems therefore quite natural that the President of the International Mathematical Union should preside over the general sessions of the Congress, and I now have the honour to call upon Professor Rolf Nevanlinna, who will declare the Congress open.

Thus Nevanlinna combined the roles of the President of the Union and the President of the Congress. (Pincherle in 1928 was a precedent.)

In the presidential address Nevanlinna first dealt with the expansion of mathematics, which had been the main theme of the addresses of the three previous Congress Presidents—Veblen in 1950, Schouten in 1954, and Hodge in 1958:

> One prime characteristic of our age is the highly accelerated pace of its development. This can be felt everywhere in our cultural, social, and economic life. It applies with greatest force to technology and science. Mathematics is no exception. To convince oneself of this, it is sufficient to glance at the questions

> dealt with in the lectures and discussions of the international mathematical congresses since the beginning of the century. The expansion and growth of many different branches of science have led to increasing specialization in the field of research. Today there is no mathematician who can claim to have mastered modern mathematics in its entirety. The development of science would soon lead to an impossible situation, if there were not another tendency working against it; the tendency towards synthesis. Mathematical development in our century stands out as a shining example of this synthesis, which is necessarily on a conceptually high and abstract level.

Nevanlinna then discussed the relations between pure and applied mathematics, a theme that became dominant in the addresses of the IMU Presidents to the Congress in the 1980s.

> What takes place in pure mathematics has its roots in the world of experience. On the other hand, theoretical and general mathematical insight throws light on practical questions, and forms, in fact, the basis of applications in many different fields; in natural science, in technology and, in recent times, in many branches of social and economic life. The astonishing development of electronic computers has contributed enormously to the applicability of mathematical methods.
>
> Thus mathematics in our time forms the background of ever increasing importance for all cultural life. Mathematicians from all over the world have come together again after four years to survey the state of our science. This survey is the principal object of a large Congress, and this opinion has been decisive in the organization of this Congress.

In his capacity of Chairman of the Fields Medal Committee, Nevanlinna reported, "The two Fields Medals are to be given, also this time, to two young mathematicians for distinguished scientific achievements: Lars Hörmander, Professor at the University of Stockholm, and John Milnor, Professor at the University of Princeton. The International Mathematical Union considers it a great honour that His Majesty the King has agreed to be present here and to give the Fields Medals to the winners of the Prizes."

Lars Gårding spoke on Hörmander's work in the theory of partial differential equations, and Hassler Whitney on Milnor's work in differential topology.

At the closing session of the Congress, Nevanlinna, as chairman of the committee to recommend the choice of the location of the next Congress, asked Academician Lavrentiev to address the gathering. In the name of the Soviet Academy of Sciences, Lavrentiev proposed that the next Congress be held in the Soviet Union. In analogy to what Nevanlinna had said

at the opening session, Lavrentiev pointed out how technological progress had opened to applications many fields of mathematics that were earlier thought to be esoteric and remote from life. The huge expansion of mathematics and the growing number of its directions of research and of those working in these areas has increased the significance of an international organization, since the forces of mathematicians of all countries must be unified more than ever. The International Congresses constitute one of the most important forms of worldwide cooperation. Lavrentiev assured unreserved contribution from the USSR: "All the resources of Soviet mathematicians will be used for organizing the next Congress, together with the International Mathematical Union, for the best of the participants and their families."

Lavrentiev's invitation was presented in Russian. After it had been translated into English by P.S. Aleksandrov, it was carried by acclamation and accepted by Nevanlinna in French [195].

8

Consolidation of the IMU (1963–1970)

The first ten years, 1952–1962, were a remarkable success for the IMU: It grew into a truly worldwide organization; mathematical conferences on specialized topics were introduced; ICMI became attached to it; and finally, the mathematical program of the ICMs and the awarding of Fields Medals became the responsibility of the IMU.

The IMU had found its main spheres of activity. During the following eight years, 1963–1970, the Union was consolidating its position. When difficulties started to mount in the 1970s, they were met by an active and widely recognized IMU, very different from the Union in the 1920s.

8.1 The USSR Hosts the 1966 General Assembly

The USSR had joined the IMU in 1957, and the isolation of Soviet mathematicians from their Western colleagues was diminishing. Yet the cooperation was so limited and the Soviet Union so little known that the decision made in Stockholm in 1962 to hold the next General Assembly and Congress in Russia aroused excited expectation.

The first plan, to hold the meeting of the General Assembly in a sanatorium of the USSR Academy of Sciences near Moscow, was later rejected. The delegates of the General Assembly were invited to Dubna, a small town on the river Volga, a hundred kilometers to the north of Moscow. The venue of the meeting, which took place during 13–16 August 1966, was the Research Center for High Energy Physics.

No advance information about the arrangements, such things as accommodation in Dubna, were given. Going directly to Dubna was clearly impossible. Dubna was not in the domain of the Soviet travel agency "Intourist." The participants were asked to come to Moscow and to give the precise coordinates of their point of arrival there. Some worry was felt, because this was a one-way correspondence: Receipt of the information provided was not acknowledged. But the deeds were better than the words. I arrived in Moscow by train from Helsinki. Walking with my wife amongst the dense crowd on the platform of the Leningrad Station, an unknown man touched my shoulder asking, "Gospodin Lehto?" Lack of a common language prevented further conversation, but the man took us by car to Hotel Ukraina, where a good number of other delegates were already assembled and buses for Dubna stood waiting.

N. Bogoliubov was present in Dubna in two capacities, as head of the Dubna Institute and as a Soviet delegate to the General Assembly. Perhaps even more than he, M.A. Lavrentiev, member of the IMU Executive Committee, represented the hosts, and not only because of his towering physical proportions. He was an important promoter of East–West mathematical cooperation during the eight years (1963–1970) he served on the Executive Committee. (In Dubna he was elected Vice-President of the Union.)

At the time of the 1966 General Assembly the Union had forty-one members. Four countries—Turkey, South Africa, East Germany, and North Korea—had joined the IMU since the 1962 General Assembly. (The distribution of membership is given in the Appendix, Section 1.) In Dubna, delegates of thirty-two member countries were present [204].

In his opening address, President de Rham gave a brief survey of the events since the previous General Assembly in 1962:

> The first object of our Union, according to the Statutes, is to promote international cooperation in mathematics. To this end we have sponsored the organisation of international Conferences and Colloquia. There were three in 1963, four in 1964, and five in 1965, in the United Kingdom, Italy, Hungary, Spain, India, Rumania, Australia, and in the Soviet Union. The subjects of the Colloquia have covered a wide range: Analysis, Geometry, Number Theory, Algebra, Topology, Probability. The reports which have been distributed show the high scientific value of these meetings. I have had the privilege of participating in three of them, in Bombay, in Bucharest, and in Erevan, and I am sure that all the participants were convinced, as I am, of the utility, and I should even say of the necessity, for such meetings. In fact, in Mathematics, experiment cannot control theory; it is only by discussion with others that we can discern and correct our errors.

Having remarked that the initiative for these Colloquia rests with the local organizers, de Rham continued by mentioning that for the year 1966, the funds of the Union had been reserved for the International Congress. The offered subvention was intended to take care of the travel expenses of invited speakers and young mathematicians. He referred to the IMU's new role: "Following a procedure which was established at the time of the Stockholm Congress and which will continue in the future, a Consultative Committee has been charged with the preparation of the scientific programme of the Congress."

In the last part of his address, de Rham dealt with ICSU and UNESCO:

> Our relations with ICSU are closer than ever, since our Secretary, Professor Chandrasekharan, after having been Vice-President for three years, has been elected Secretary-General at the beginning of this year at the ICSU General Assembly held in Bombay. That indicates well the confidence that all the international community have in him and shows once more how one may rely on his utmost devotion. Each year we receive from ICSU and UNESCO a grant which is reserved for purely scientific activities, and which acts as a catalyst for the Colloquia I have mentioned.... In concluding these words of introduction, may I express the wish that our discussions and deliberations will be held in an atmosphere of frank and friendly serenity? May I appeal to the goodwill and spirit of understanding of everyone, for the greater good of our Union?

The Commission for Documentation of Mathematical Literature and for Scientific Publications had been dissolved by the 1962 General Assembly. Although all projects to include mathematical publications in the Union's sphere of activities had failed, a new attempt was again made: "The General Assembly is in favour of a project directed by the Executive Committee towards improving the existing system of reviewing mathematical papers.... Referees of papers which are accepted by Journals may be invited by the Journals themselves to furnish a short review or preview on a voluntary basis. Such reviews may then be forwarded to any one or more of the reviewing Journals for use at their discretion. In no case should the review of the paper be published before the definitive form of the paper is ready for printing." This resolution did not lead to any action.

The important resolutions about the IMU's position at the ICMs (Fields Medals, scientific program, site of the next Congress) that were adopted by the 1962 General Assembly were again adopted almost verbatim. Since dues were not raised, the recommended budget for the years 1967–1970 was approved without much discussion (cf. "Finances" in the Appendix, Section 12) [205].

The following Executive Committee was elected for the four-year period beginning 1 January 1967.

FIGURE 8.1. Henri Cartan (born 1904). French mathematician (various domains of analysis). Vice-President of the IMU 1963–1966, President 1967–1970. Member of the Fields Medal Committee for the Amsterdam Congress 1954. Chairman ex officio for the Nice Congress 1970.

President: H. Cartan (France)

Vice-Presidents: M.A. Lavrentiev (USSR), D. Montgomery (USA)

Secretary: O. Frostman (Sweden)

Members: M.F. Atiyah (U.K.), K. Chandrasekharan (India), G. Hajós (Hungary), G. Vesentini (Italy), K. Yosida (Japan)

Past President: G. de Rham

President Henri Cartan (Fig. 8.1) had a longtime affiliation with the Congresses and the IMU. He attended the Strasbourg Congress 1920 (accompanying his father Elie Cartan), where the old IMU was founded. Eight years later at the ICM-1928 he was already a member in his own right. He was present in Zurich in 1932 when the IMU was dissolved, and was a delegate of France at the Constitutive Convention of the new IMU in 1950

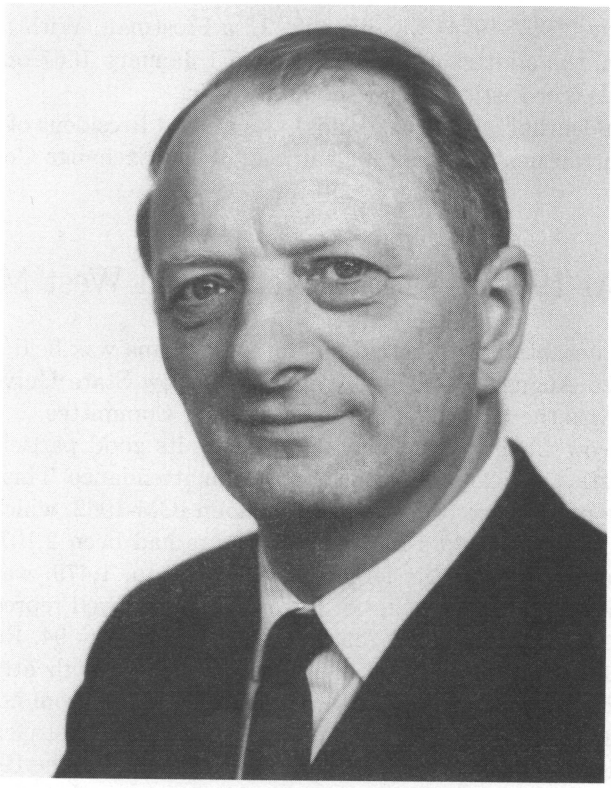

FIGURE 8.2. Otto Frostman (1907–1977). Swedish mathematician (complex analysis). Secretary of the IMU 1967–1974. (Courtesy the Royal Swedish Academy of Sciences.)

and at the first General Assembly in 1952. During the four-year period 1963–1966 preceding the Dubna Assembly, he served as Vice-President of the Union.

Before the election of Frostman (Fig. 8.2) was sealed, other names had arisen as candidates for Secretary. The Executive Committee first asked Chandrasekharan to continue, but he declined. Stone, the former President of the IMU and of ICMI, had suggested that he should be considered a candidate if and only if Chandrasekharan decided to retire from that office [206]. At the last moment in Dubna, the Soviets began to have second thoughts about Frostman (who was proposed by the Executive Committee), but Past President Nevanlinna persuaded them to accept him.

In 1966 Frostman was President of the Royal Swedish Academy of Sciences. He might well have received secretarial help from the Academy for the transaction of the Union's business, but he preferred to keep the IMU in the family: His coworker for the affairs of the Union throughout his term

as Secreatary (1967–1974) was his wife, Lisa Frostman. With the election of Frostman, the address of the Union from 1 January 1967 on was to be the Mittag-Leffler Institute, Djursholm, Sweden.

Hans Freudenthal (the Netherlands) was elected President of ICMI, and Friedrich Hirzebruch (Germany) Chairman of the Exchange Commission.

8.2 ICM-1966 in Moscow: East and West Meet

The 1966 International Congress of Mathematicians was held in Moscow during 16–26 August 1966. The Rector of Moscow State University, I.G. Petrovskii, was the Chairman of the Organizing Committee.

The Moscow Congress was characterized by its good participation. By Soviet statistics, 4,282 mathematicians were in attendance. This more than doubled the previous record: At the Stockholm ICM-1962, which had been the largest Congress before Moscow, the figure had been 2,107. As could be expected, in Moscow the largest national group, 1,479, was from the USSR. Other Socialist countries of Europe were also well represented: the German Democratic Republic 229, Poland 120, Hungary 94, Romania 88, Bulgaria 81, Czechoslovakia 60. But Moscow held a high attraction for mathematicians from the West as well. Over 2,000 came from non-Socialist countries, including USA 725, Britain 286, France 280, West Germany 169, the Netherlands 92, Sweden 89, Canada 83, Italy 70 [207]. The 1966 Moscow Congress made history in offering an opportunity unequaled to this day for mathematicians from the West and the East to meet each other.

The abbreviation ICM, which had hardly been used before, became well known in Moscow, being visible on signs everywhere. Moreover, the USSR issued a stamp on the occasion of the Congress, on 20 July 1966 (Fig. 8.3). The large letters "ICM" occupy the center part of the stamp. And finally, for the first time, ICM was printed on the cover of the Congress Proceedings [208]. Thus ICM can be regarded as a Russian invention, a proof that English had become the lingua franca in mathematics.

Before the Congress, much work had been done by the Consultative Committee, with Nevanlinna as Chairman. Four of its other members were appointed by the IMU, four by the Soviet Organizing Committee. (The composition of the Consultative Committees is given in the Appendix, Section 8.) By the resolution adopted in Saltsjöbaden, the Consultative Committee was all-powerful in matters regarding the mathematical program. This was not yet understood by the Soviet organizers, who seem to have thought that like the Swedish organizers in 1962, they had the last word.

Following an invitation of Petrovskii, Nevanlinna visited Moscow in September 1963 for preliminary discussions. There Nevanlinna was presented a detailed plan about the sections, the composition of panels, and the num-

FIGURE 8.3. The Congress stamp issued in the USSR. It advertised the acronym ICM, which had not been in common use before the 1966 Moscow Congress.

ber and type of invited lectures and short communications. Consequently, instead of starting with a clean slate, the Consultative Committee was presented a fait accompli and had to begin its work by taking a stand on the Soviet proposals. Eventually, consensus was reached. The Committee member Armand Borel praised Chairman Nevanlinna for showing much skill in the negotiations [209]. Nevanlinna, who had been appointed by President de Rham, was under the impression that his chairmanship had been specially desired by Soviet mathematicians [210].

Until the end, the position of the Consultative Committee remained unclear to the Soviet hosts. Petrovskii, who was elected President of the Congress, explained the setup of the program as follows: "All decisions of the International Mathematical Union regarding the number of sections, the choices of hour and half-hour addresses, were fully accepted by the Soviet Organizational Committee. We only allowed ourselves to add several talks to these recommendations" [211]. The freedom to add a few local mathematicians to the list of invited speakers was so broadly interpreted by the Soviets that about one-third of the invited lecturers were from the USSR.

The opening ceremony of the Congress was held in the Kremlin, in the theater of the new Congress Building. After M.V. Keldysh, the President of the Soviet Academy of Sciences, had welcomed the participants, de Rham spoke in his capacity as Chairman of the Fields Medal Committee. In the five ICMs before Moscow in which Fields Medals had been awarded, the number of Medals had always been two. Now four Medals were given, and de Rham explained the reason.

Quoting the part of the Memorandum of Fields (Section 3.1) that stipulates that because of the multiplicity of the branches of mathematics and taking into account the fact that the interval between the Congresses is

four years, at least two medals should be available, de Rham said, "In view of the vast development of Mathematics during the last forty years, it appears that this number could judiciously be increased to four. The Executive Committee of the International Mathematical Union has therefore viewed with sympathy the generous offer made by an anonymous donor to give this year two more medals. The Organizing Committee of this Congress having agreed to this and the Medals Committee having accepted the responsibility to select four names, four medals will be awarded today."

In fact, the Executive Committee of the IMU had accepted at its meeting in 1964 the offer of the Sir Dorabji Tata Trust, India, to institute two medals, called Tata Medals. They would be similar to the Fields Medals and awarded at the same time with them. The same Committee should select the Fields and the Tata medalists. However, because of the currency restrictions in force in India, the Reserve Bank of India declined to permit the transfer abroad of the necessary funds [212]. Only two Fields Medals would have been awarded in Moscow save for the anonymous donor.

Fields had wished in his Memorandum that "while making the awards was in recognition of work already done, it was at the same time intended to be an encouragement for further achievements on the part of the recipients and a stimulus to renewed efforts on the part of the others" (Section 3.1). For the first time, this rather vague wish was given a precise interpretation. Having referred to it, de Rham said, "On the basis of this text, and following precedent, we confine our choice to candidates under forty."

De Rham then explained how a preliminary list of about thirty names was gradually reduced. Before the final decision, the Committee had to give up several names that would also have deserved this distinction. "Several young mathematicians of extraordinary brilliance were among them. But because they are so young, there will be many Congresses before they reach forty, and if they continue in their course, they will have every chance of receiving a medal. The choice was thus not easy. Nevertheless, after serious consideration and reflexion, we arrived at a conclusion without undue difficulty. The following four names, in alphabetical order, constitute our choice: Michael Francis Atiyah, Paul J. Cohen, Alexander Grothendieck, Steven Smale. Unfortunately, A. Grothendieck was unable to come. May I call Messrs. Atiyah, Cohen, and Smale to come forward and receive these medals from the hands of Academician Keldysh" [208].

The work of Michael Atiyah was presented by H. Cartan, who concentrated on explaining Atiyah's contributions to K-theory, the index theorem, and the Lefschetz fixed point formula. Thanks to Atiyah's work, topology and analysis have been put in close relation. Alonzo Church spoke about Paul Cohen's solution of the continuum hypothesis, which had been the first on Hilbert's famous list of 1900. J. Dieudonné compared Alexander Grothendieck to Hilbert, and he condensed his talk by saying that Grothendieck was the principal craftsman in the renovation of algebraic geometry. René Thom, after explaining why Stephen Smale's dissertation

of 1956 was a seminal paper, spoke of Smale's great work on Poincaré's conjecture, which opened a whole chapter in differential topology.

A Soviet report on the Congress described Smale's activity against the Vietnam war and remarked that in Moscow, Smale criticized American involvement in Vietnam to the press [207]. The report did not mention that on the same occasion Smale also criticized the USSR for its lack of the basic freedom to protest.

The mathematical activities of the Congress took place at Moscow State University, a little outside the center of the city. The Congress members were accommodated in hotels over a vast area, and they had to do a considerable amount of commuting. But this was made easy by the huge armada of special buses that were at the free disposal of the Congress members. In the skyscraper University main building, said to be the largest building in Europe, the elevators were stretched to their utmost, or more. The composition of participants caused more language problems than usual. Systematic interpretation was not provided (as it never is at the ICMs), but ad hoc arrangements based on help from colleagues eased the difficulties.

At the closing session of the Congress, de Rham spoke as President of the IMU. Having reported on the General Assembly held at Dubna, he continued:

> The first object of the International Mathematical Union is to promote international cooperation in Mathematics. In respect to this, the most striking fact during the last ten years has been the progressive cooperation between mathematicians in the Soviet Union and other countries, especially of Western Europe and the USA. It is a particular pleasure for me to emphasize the important position occupied by Soviet mathematicians in our Union. Their contribution to the development of our Science is of the highest significance. This will continue to increase, due to the abundance of brilliant young Soviet mathematicians. Mathematicians of all countries welcome every opportunity to meet them. May I express the wish that such contacts will grow, for the benefit of all.

At the time of the Moscow Congress, which had been preceded in 1965 by a successful IMU-sponsored international conference on Analysis organized by the Soviet Academy of Sciences in Erevan, Armenia, there was optimism about increasing mobility of Soviet mathematicians and improving contacts with them. Unfortunately, political developments were such that a setback was soon to come and the high expectations were not met.

At the closing session, J. Dieudonné, Dean of the Faculty of Sciences of Nice, speaking on behalf of the French National Committee for Mathematics, invited the International Congress of Mathematicians to hold its 1970 meeting in France. The city of Nice, thanks to its location, its climate,

its tourist facilities, and the existence of an active University, fulfilled the conditions required for the site of a scientific conference [208].

8.3 The 1970 General Assembly in France

Towards the end of the 1960s, a political event suddenly shattered the coexistence between East and West. In August 1968, Czechoslovakia was occupied by the armed forces of the USSR, Poland, the German Democratic Republic, Hungary, and Bulgaria. The National Committee for Mathematics of Czechoslovakia approached President Cartan with an appeal: "At this grave moment of our history we entreat you as the President of the International Mathematical Union to give moral support to the cause of our country. Only the restoration of the sovereignty of the Czechoslovak Socialist Republic and the complete withdrawal of all foreign troops from its territory will permit further free development of our science and culture."

The appeal represented a problem resembling those the IMU was to encounter again on occasion in the 1980s. When a possible response was being pondered, many of the members of the Executive Committee of the IMU found it problematic how to manifest sympathy to the Czech colleagues without causing them additional difficulties. The Soviet Vice-President Lavrentiev restricted himself to the pertinent remark that an organization like the IMU should not become mixed with political relations between countries. The Executive Committee decided not to take any official action. The case was closed in January 1969, when the President of the National Committee for Mathematics of Czechoslovakia sent a letter to Cartan thanking him for the attention the Union had devoted to their cause and adding that under the present circumstances, further steps on the part of the IMU were not necessary.

The Czechoslovak episode was kept confidential within the Executive Committee and was not publicized until 1995, by Cartan [213]. Nothing was said about Czechoslovakia at the meeting of the General Assembly in 1970, over which Cartan presided.

Comparison of the presidential addresses at the General Assemblies in 1966 and 1970 shows that during the eight-year period 1963–1970, the IMU had found a stable course. The addresses given by President de Rham in Dubna in 1966 and President Cartan in Menton in 1970 were identical in structure. Both treated the same topics in the same order, largely with the same words. It is true that during the 1967–1970 period, ICMI inaugurated a development of major importance. But viewed from the IMU, this had been done so furtively that Cartan did not mention it in his address.

The Sixth General Assembly of the International Mathematical Union was held in Menton, on the French Riviera, during 28–30 August 1970. The sessions took place in the congress center Palais de l'Europe, in the

middle of town. At the three previous General Assemblies the delegates were accommodated more or less under the same roof; now they stayed in various hotels. They were not widely scattered though, thanks to the small size of Menton.

Accidentally, I became aware of an organizational pitfall caused by the dual responsibility for the General Assembly shared by the IMU and the local hosts. On the day before the opening of the Assembly, I went to Palais de l'Europe, just to have a look at the meeting place. The timing of my dropping in happened to be such that I found there Secretary Frostman, his wife, and a Swedish secretary, rushing back and forth in great agitation. Frostman was happy to find a delegate to whom to pour out his feelings in his native Swedish. "The French were supposed to arrange everything for the meeting, but look, nothing has been done. How can the meeting be opened tomorrow morning?" It turned out that the staff of Palais de l'Europe had not received appropriate instructions. But they were cooperative professionals, and in a couple of hours all the required tables and chairs emerged and were carried to the right places. Microphones were installed, copies of the necessary documents were made, and so on. For me, witnessing the messy moments was a useful reminder when I later became engaged with the organization of General Assemblies, first as a local host and later as Secretary of the Union.

At the time of the 1970 General Assembly, the IMU had forty-two members, one more than in 1966, New Zealand having been admitted in 1969.

As four years earlier, the main part of the presidential opening address to the General Assembly dealt with the mathematical activities of the Union. The ten Colloquia the IMU had sponsored and supported financially were mentioned. Cartan then spoke at some length of the "now well-established procedure" concerning the preparation of the 1970 ICM. As in Dubna in 1966, the General Assembly confirmed the arrangements to be applied next time. And as in Dubna, the General Assembly noted with satisfaction the high degree of cooperation that had prevailed between the Committees of the Union and the Organizing Committee of the Congress and the great value inherent in such a cooperative international enterprise. The adopted Resolutions repeated word for word the procedure adopted by the 1962 General Assembly and reconfirmed in 1966.

Cartan briefly remarked that "among the permanent commissions of the Union, the International Commission on Mathematical Instruction plays a special and very important role. Professor Freudenthal has been Chairman of ICMI for the last four years. He has been very active and has initiated measures that could be fruitful in the coming years." The remarkable news (not mentioned in Cartan's address) was that in 1969, ICMI had organized an International Congress on Mathematical Education (ICME). This meant an essential additional feature in the Union's activities. However, the opinion of the IMU Executive Committee about ICMEs had not been

sought. The break of contact between the IMU Executive Committee and ICMI and the formation of ICMEs is discussed in Section 11.2.

The report of the Commission on Exchange of Mathematicians concluded as follows: "The committee should continue to support exchange mainly between those countries where problems of foreign money exchange and similar problems make the exchange of mathematicians difficult and where exchange is not yet existing on a wide basis by other means."

Here seeds of a new policy could be seen that further pursued was to alter the character of the Commission eight years later. The closing words of Cartan's address were in the same direction: "We must never forget that our first duty is to provide the means for the best development of our science, particularly by encouraging young people of developing countries. I am sure that the goodwill of everyone will lead to a successful conclusion of our common work."

Handling the proposed budget gave rise to considerable discussion, since it was suggested and ultimately decided to raise the unit contribution to \$130.40 (from 300 to 400 gold francs). The General Assembly never likes increasing dues. Opposition against higher dues was easy to understand when coming from delegates of countries with nonconvertible currencies, where securing the required funds was sometimes a real problem. But the philosophy could also be discerned that a mathematical organization like the IMU should be modest in its use of funds. In particular, the costs of administration should be kept as small a possible.

Authorized annual expenditure for the period 1971–1974 totaled \$10,200 for schedule A (administration) and \$6,000 for schedule B (scientific activities). As usual, thanks to support from ICSU and other outside sources, more funds were actually available for mathematical purposes.

The General Assembly elected the following Executive Committee for the four-year period beginning 1 January 1971.

President: K. Chandrasekharan (Switzerland)

Vice-Presidents: A.A. Albert (USA), L.S. Pontryagin (USSR)

Secretary: O. Frostman (Sweden)

Members: M.F. Atiyah (U.K.), Y. Kawada (Japan), N.H. Kuiper (the Netherlands), M. Nicolescu (Romania), E. Vesentini (Italy)

Retiring President: H. Cartan (France)

M.J. Lighthill was elected President of ICMI. The General Assembly decided that the Past President of ICMI, the Secretary of the IMU, and the representative of the Union on ICSU's Committee on the Teaching of Science should be members ex officio of ICMI. Hirzebruch was reelected Chairman of the Exchange Commission.

As it was now twenty years since the foundation of the Union, the Executive Committee had decided that all participants of the excursion in Provence, planned for 30 August 1970, should be guests of the Union. According to the official report, "the General Assembly appreciated the decision" [214].

8.4 ICM-1970 in Nice

The 1970 International Congress of Mathematicians was held in Nice during 1–10 September. Deviation from the customary dates in August was said to have been necessitated by the tourist high season in Nice before September. About 2,800 mathematician members attended the Congress.

The scientific program was in the hands of a joint IMU–French Consultative Committee. If the Soviets had been of the belief that the Consultative Committee was subject to the Organizing Committee, the French organizers first forgot about the rules totally and began planning the mathematical program blissfully unaware of the requirement of an international Consultative Committee [215]. The Consultative Committee was established in the spring of 1967, with A. Adrian Albert (Fig. 8.4) as Chairman (cf. the Appendix, Section 8).

The organization of the mathematical program followed a new principle. No short communications were presented orally; instead, they were received in advance of the Congress, mimeographed, and distributed to all participants at the beginning of the Congress. At the closing session of the Congress, Dieudonné, who was in charge of the local arrangements but not a member of the Consultative Committee, spoke:

> This Congress is the first one in which there are no ten-minute talks, although printed communications have been accepted. The decision to allow only lectures given by invitation was taken unanimously by the international advisory Committee and the Organizing Committee. Of course, the corresponding Committees for the 1974 Congress are not bound by this decision and may adopt a different policy. But the Organizing Committee thinks that it might be useful for the organizers of the 1974 Congress to have the opinion of this Congress regarding the new organization of the lectures. I will therefore ask those who are in favour of the continuation of the policy adopted in the 1970 Congress, namely to have only one-hour and fifty-minute invited talks, plus written communications, but no ten-minute talks, to raise their hands. Against this continuation and for a return to the previous tradition? Abstentions?

The result was that there were about twice as many votes against short communications as for them. Nevertheless, short communications were al-

FIGURE 8.4. A. Adrian Albert (1905–1972). American algebraist. Vice-President of the IMU 1971–1972. Chairman of the Consultative Committee for the Nice Congress 1970. (Courtesy AMS.)

lowed again at the ICM-1974 and thereafter. So far, the ICM-1970 is the sole exception in this respect.

There were sixteen invited lectures of one hour each, of a general character intended for all members of the Congress. These were given every morning, with no other scheduled activities. In addition, there were about 265 invited lectures, of thirty to fifty minutes each, in thirty-four sections. They were given in the afternoon, ten lectures running at the same time. According to the Congress report, "about 125 of the invited speakers came from the USA, about 65–70 from the USSR (23 of the speakers invited from the USSR could not come)." Outside the official program, there were many meetings voluntarily organized by individuals or groups, with facilities put at their disposal by the Organizing Committee [216].

The IMU had sought to encourage the participation of young mathematicians whose names had been recommended by the respective National Adhering Organizations. A contribution was made towards the cost of travel and accommodations to about thirty young mathematicians. It was specifically agreed that no applicant should receive the total sum of his expenses (this policy was later changed). The sum should be at least $50 and at most $400 [217].

The Congress was opened by the National Minister of Education, Olivier Guichard. J. Leray was elected President of the Congress and P. Montel Honorary President.

As in Moscow in 1966, four Fields Medals were awarded. The Secretary had been informed by the Canadian National Trust Company Ltd., which managed the Fields Trust, that the income was sufficient to permit four Medals and four cash awards of $1,500 each. The warning was added, though, that in the future the income would be sufficient to permit only two awards [217].

Speaking as Chairman of the Fields Medal Committee, Cartan announced that the Committee had, not without hesitation, conformed with the tradition that only mathematicians under age 40 could be considered. The original list of twenty candidates was eventually reduced to four. The choice was difficult, but the Committee was convinced that each of the awardees had contributed to giving a new image to an important branch of mathematics. The Fields Medal winners were Alan Baker (U.K.), Heisuke Hironaka (Japan), Sergei Novikov (USSR), and John G. Thompson (USA). The Medals to Baker, Hironaka, and Thompson were presented by Minister Guichard; Novikov had been unable to come to Nice.

Novikov received his Fields Medal a year later. In September 1971, an international conference took place in Moscow on the occasion of Vinogradov's eightieth birthday. At the same time, the IMU Executive Committee held a meeting there. A dinner was given in honor of Novikov, at the end of which he received the Fields Medal from the hands of Cartan, then Past President of the Union [218].

A report on Baker's work on the theory of transcendental numbers was given by P. Turán. Hironaka's work in algebraic geometry was presented by A. Grothendieck. Novikov's work in geometric and algebraic topology was presented by M.F. Atiyah, and Thompson's work on finite simple groups by R. Brauer.

At the closing session, H.A. Heilbronn, speaking on behalf of the Mathematical Society of Canada and the University of British Columbia, issued an invitation to the 1974 International Congress of Mathematicians to be held in Vancouver.

During the Menton General Assembly it was already a well-known secret that the ICM-1974 would take place in Canada, but two cities, Montreal and Vancouver, were mentioned. According to the story circulating in Nice, outsiders had a say in the final decision. At the time of the Congress there was a heat wave in Nice, which made many participants unhappy. Having heard that in all probability Montreal in August would be still warmer than it was now in Nice, they were definitely in favor of the cooler Vancouver.

For a while, both Canada and the USA had expressed interest in hosting the ICM-1974. With voices from the USSR requesting that instead of North America, a different country, convenient for all, be found, President Cartan approached Finland as a possible alternative. As Chairman of the Finnish

National Committee for Mathematics, I drafted an answer that left the door ajar but made it clear that Finland would not compete with any country regarded as acceptable by the IMU. Soon the USA expressed its support for Canada, which was chosen by the Site Committee. In the minutes of the twenty-fifth and twenty-sixth meetings of the Executive Committee, the conditional Finnish option was recorded as an application; the wording was later corrected in the report Secretary Frostman sent to the members of the Site Committee [219].

9

North–South and East–West Connections (1971–1978)

Two different movements characterized the Union's eight-year period in the years 1971–1978. During this time mathematics was making marked progress in developing countries. The IMU became increasingly aware of the importance of supporting this evolvement. In 1978 the subcommission on Development and Exchange was founded.

On the other hand, the disagreement between the IMU and the Soviet National Committee for Mathematics about the preparation of the mathematical program of International Congresses began to disturb East–West mathematical relations. At the 1978 General Assembly the discussions about the North–South connections and the Soviet disagreement played a prominent part.

9.1 New Programs and Trends

Under President Chandrasekharan, new initiatives were taken and new programs launched in the early 1970s. The publication *IMU—Bulletin of the International Mathematical Union*, which Chandrasekharan had already proposed in the 1950s, began to appear. The first issue, edited by Secretary Frostman, came out in January 1971. In its "Foreword," the retiring President Cartan wrote:

> The International Mathematical Union, in its present form, has completed twenty years of existence. Reports of the Union's activities during this period have been sent out to member coun-

> tries as required under the statutes and by-laws. Some of them have also been published, by arrangement, in the *Bulletin of the Austrian Mathematical Society.* In view of the expanding role of the Union, it has seemed desirable to keep a continuous and easily accessible record of its activity. This is now being done in the form of an IMU Bulletin, of which this is the first issue [220].

This meant the end of the close cooperation with the International Mathematical News of the Austrian Mathematical Society, which had rendered valuable service to the Union since 1952.

A remarkable plan to increase further the role of the IMU at International Congresses was discussed and agreed upon by the new Executive Committee at its first meeting in Zurich in May 1971. President Chandrasekharan spoke of the advantages that would accrue from IMU's sponsorship of the Proceedings of the ICM as a serial publication, uniform in format and size, easily accessible in libraries, and convenient for bibliographical reference. This would relieve the Organizing Committee of a financial burden. The IMU would not use the Proceedings to "beat its own drum," but to try to render a service to the organizers, who had an increasingly difficult job to tackle.

The Executive Committee agreed that contact should be made as soon as possible with the Canadian organizers to obtain their cooperation. The Fields Medals had originated in Canada in 1924 and were internationalized about seven years later. In 1974, fifty years later, "it would be fitting for Canada to give a new lead in the publication of the Proceedings" [221]. Yet, contact was not made with the Canadians [222]. The Executive Committee may have realized that the Union possessed insufficient resources for the editing and publishing of the Proceedings. A renewed initiative has not been taken by the IMU.

As a modification of the previous "IMU Lecturers Program," a new program, "Union Lectures," was introduced in 1971. The Executive Committee

> decided to invite, from time to time, a distinguished and active mathematician, of international standing, to give a set of four to six lectures, on important new developments in mathematics to which the lecturer himself, directly or indirectly, has made a contribution, and which deserve to be "surveyed" at some length, for the benefit of younger mathematicians as well as others. The lectures are intended to be on about the same level as the one-hour survey lectures given at the International Congress of Mathematicians, but fuller, in greater detail, and more often than once in four years, though perhaps not in the year of the International Congress. The lectures are to be given at mathematical centres where an interested and competent audience of younger mathematicians is easy to presuppose. It is

> intended that in order to disseminate the benefits of such "survey lectures," either the lecturer himself, or a member of his audience, will write them up for publication within six months or so of their delivery, and that arrangements will be made, if there is demand as well as justification, for their translation into another language. The Executive Committee has decided that the Union Lectures will, for the time being, be published in the *L'Enseignement Mathématique*. It is assumed that interested mathematical centres will make proposals for such lectures to the Union, and that the Executive Committee of IMU will be free to select a lecturer, or not, and designate him a Union Lecturer. It is expected that there will be not more than two such per year. The business of organizing the lectures, paying the lecturer's expenses, and preparing the lectures for publication belongs to the mathematical centre that initiates the proposal [223].

The first two series of the Union Lectures were given by Wolfgang M. Schmidt on "Approximations to algebraic numbers" and Lars Hörmander "On the existence and regularity of solutions of linear differential equations," both of the Institute for Advanced Study, Princeton. In these cases and later (Hirzebruch, J.-L. Lions, and Mumford were the next lecturers), the standard was such that being named a Union Lecturer was undoubtedly a high distinction.

However, these lectures were not as widely noticed as they should have been, since the advertising journal, the IMU Bulletin, did not reach the desired circulation. The first lecturers conscientiously submitted their manuscripts as had been agreed. Later, this was not always the case, and the Union Lectures became even less well known. (A list of Union Lectures is given the Appendix, Section 11.)

As before, an important part of the Union's activities was to cosponsor International Colloquia and Conferences on special topics. Here, too, a new trend could be perceived. More than before, attention was paid to applied mathematics. At the meeting of the Executive Committee, held in June 1973 in Frankfurt am Main, this was recorded explicitly: "The EC affirmed the general policy of IMU of pursuing activities not only in pure but also in applied mathematics in a broad sense, giving as proof thereof the cooperation with the theoretical physicists at the Moscow Conference (held in December 1972), the sponsorship of the Warsaw Symposium on Optimization Theory (in 1973), and the Study Group appointed at the instance of IUTAM" [224]. (More about the IMU and IUTAM (International Union of Theoretical and Applied Mechanics) and, more generally, about the IMU and applied mathematics, will be related in Section 11.5.)

In 1971 the IMU began to pay increasing attention to mathematics in the Third World. At the 1971 meeting of the IMU Executive Committee,

an action was initiated that was to have far-reaching consequences. The Executive Committee resolved to set up an International Group "to assist the Executive Committee of IMU in advising other international organizations, governmental or nongovernmental, on projects designed to encourage the growth of mathematics in the developing countries, and to suggest to the Executive Committee possible arrangements between existing research institutes and universities designed toward the same end."

Before the 1970 Congress, dialogue between the IMU and mathematicians from developing countries had increased, and the Union had provided funds for young mathematicians from developing countries to participate in the Nice Congress. The 1971 decision to set up the International Group was a concrete step to enlarge the responsibilities of the Union. The composition of the Group was a further proof of the Union's serious aim to do something [224]: Chairman: A.A. Albert, Vice-President of the IMU; Secretary: N.H. Kuiper; Member ex officio: IMU's Secretary Frostman; Members: M.F. Atiyah, H. Cartan, B. Eckmann, S. Iyanaga, M.S. Narasimhan, E. Vesentini, M.V. Keldysh (later replaced by I.M. Vinogradov), M. Nicolescu.

At its meeting in Harrison Hot Springs just before the General Assembly, the IMU Executive Committee agreed that for the encouragement of mathematics in developing countries, regional groups for Africa, Europe, Asia, Australasia, and North and South America could be considered. Each group could have a Coordinator and should work by correspondence. The Exchange Commission should include these Coordinators, as well as the Secretary of the Union ex officio, and possibly other elected members. These recommendations of the Executive Committee were endorsed by the 1974 General Assembly.

In 1978, this development led to the founding of a permanent subcommission of the IMU, the Commission on Development and Exchange (CDE) for the promotion of mathematics in developing countries. Section 11.3 will deal with the activities of this Commission.

In 1972, between the 1970 and 1974 General Assemblies, Vice-President Albert died. To fill the vacancy, Nathan Jacobson (USA) was elected Vice-President until the end of 1974 [225].

9.2 The 1974 General Assembly in Canada

The 1974 General Assembly was held during 17–19 August in Harrison Hot Springs, British Columbia, Canada. Harrison Hot Springs is a resort area about a hundred kilometers to the east of Vancouver, in a valley surrounded by the Rocky Mountains. The participants were accommodated at the Harrison Hotel, where all sessions took place.

The membership of the Union had remained almost constant: forty-one in 1966, forty-two in 1970, and again forty-two on 1 January 1974. After the 1970 General Assembly, Nigeria had been admitted to the IMU as the second African country (South Africa had joined in 1963), and Malaya-Singapore had withdrawn. Several countries had been raised to a higher Group of Adherence. (See the Appendix, Section 1.)

At the Harrison Hot Springs Assembly, thirty member countries were represented. In his presidential address, Chandrasekharan referred to the new developments described in the previous section:

> During the four years that have passed since the Assembly met at Menton, the Union has not only maintained its pace, but attempted to strike out in new directions. We have actively sought to encourage interdisciplinary activity, and taken the initiative to collaborate with other Unions belonging to ICSU. Within our modest budget, concrete steps have been taken by the Executive Committee towards encouraging young mathematicians from developing countries. A new program of Union Lectures has been launched. We have founded the IMU Bulletin to improve the flow of information about the Union's activities. The IMU Canberra circulars, edited and issued for the Union by Professor B.H. Neumann, disseminate information about mathematical events of international interest.

After reviewing the international Symposia and Conferences sponsored or supported by the IMU, Chandrasekharan spoke about the role of the Union in encouraging young mathematicians from developing countries. Thanks to a special ICSU–UNESCO grant, the Union had doubled the grants enabling young mathematicians to attend the ICM-1974. The Executive Committee had also tried to launch an IMU-Fellowship program for them. Each Fellowship carried a modest stipend ($2,000 a year), augmented if possible, and if necessary, by support from other sources. Speaking about the first steps in this direction, Chandrasekharan condensed the IMU policy regarding developing countries as follows: "The object of the Union is, and should be, to harness the goodwill, and knowledge, of the world mathematical community in encouraging the growth of mathematics in the disadvantaged areas of the world. Our resources may be small; but we can help in ensuring the maintenance of high standards, independently of nationalistic or political considerations."

For the first time, the President of the IMU found it necessary to recall that as a member of ICSU, the Union was committed to the principle of free circulation of scientists. The IMU Executive Committee, through its Zurich Resolution of March 1974, had appealed to all National Committees to uphold this principle, particularly in relation to the International Congresses of Mathematicians. (The principle of free circulation of scientists will be discussed in more detail in Section 11.1.)

In the discussions related to ICMI, the current trends also surfaced. The adopted resolution stated that "the General Assembly expresses its great appreciation of the activities of ICMI in every aspect of mathematical education, particularly in developing countries, and its hope that this work will grow, and that the mathematical needs of other disciplines will be taken into consideration." (ICMI is dealt with in Section 11.2.)

In Harrison Hot Springs, the finances of the Union occupied an exceptionally large part of the discussions. For some years, the Executive Committee had been worried about the state of the Union's finances, as the income had proved to be below the growing needs. Chandrasekharan referred to this in his address: "The maintenance of the Union's role in the international world of science requires adequate funds. We do not need to imitate or compete with international intergovernmental agencies. But we do need to be self-reliant in the pursuit of our modest aims. One of the important tasks before this Assembly is to look into that question."

The agenda contained proposals for the amendment of the statutes concerning the dues payable by members. After a detailed discussion, the Assembly accepted the recommendation of the ad hoc Committee that had been set up during the meeting. Each National Adhering Organization should pay an annual subscription in accordance with the Group in which it adheres, such that in Groups I, II, III, IV, V, the number of unit contributions would be 1, 2, 4, 7, 10. (The previous scale had been 1, 2, 3, 5, 8.) The long discussions showed how delicate an issue could become if it was felt that countries were being ranked. In the small ad hoc Committee, the recommendation, which the Assembly accepted, was swiftly and easily reached.

According to the statutes, the unit contribution shall be determined by the General Assembly. The Assembly decided to abandon the gold franc and to fix the unit contribution at 600 Swiss francs. This decision was easier to take than the amendment of the scale, even though it had a much greater influence on the Union's finances. It meant, in fact, that the unit contribution was raised by about one hundred percent. The adoption of the Swiss franc as the currency of the IMU made the economy of the Union more stable in the years to come. The dollar was not forgotten, though. As before, the IMU had to submit its accounts to ICSU each year, and these accounts had to be in dollars. Besides, during the years 1975–1982 the IMU still undertook mostly dollar-based commitments.

The decisions of the 1974 General Assembly marked a turning point in the finances of the IMU. From 1975 on, the Union was no longer dependent on subventions from ICSU and UNESCO to the degree it had been before. Moreover, in the IMU budget for the period 1975–1978, the funds for mathematics exceeded for the first time those put aside for administration. The Assembly authorized an annual expenditure of 50,250 Swiss francs in Schedule A (administration) and 75,750 Swiss francs in Schedule B (scientific activities). In addition to the relative shift from A to B, these

figures were considerably higher than ever before. (See the Appendix, Section 12; as mentioned before, the position of mathematics was always better than what the figures of the IMU budget indicated, thanks to contributions from ICSU and UNESCO and because funds could be moved from A to B.)

The Assembly elected the following Executive Committee for the four-year period starting 1 January 1975:

President: Deane Montgomery (USA)

Vice-Presidents: J.W.S. Cassels (U.K.), M. Nicolescu (Romania)

Secretary: J.-L. Lions (France)

Members: E. Bombieri (Italy), M. Kneser (Federal Republic of Germany), O. Lehto (Finland), M. Nagata (Japan), L.S. Pontryagin (USSR)

The retiring President, K. Chandrasekharan, was to be an ex officio member, without vote.

Montgomery (Fig. 9.1), from the Institute for Advanced Study, Princeton, was the second American President of the Union, twenty years after Stone. With the election of Lions (Fig. 9.2) as Secretary, Paris was to be the domicile of the Union (for the years 1975–1982, since Lions served two four-year terms). The Collège de France (Fig. 9.3) became not only the address of the IMU, but the meeting place for the Executive Committee, with only a few exceptions. Secretarial expenses of the Union were to be covered to a great extent from French sources.

The General Assembly elected Members at large of ICMI, as well as Members of the Exchange Commission and of six Regional Advisory Groups. S. Iyanaga (Japan) was elected President of ICMI, and A.J. Coleman (Canada) Chairman of the Exchange Commission.

The Resolutions concerning the role of the IMU at the International Congresses of Mathematicians, which had been accepted in 1962 and reconfirmed in 1966 and 1970, were reconfirmed again. After so many repetitions, most delegates must have regarded the item as a self-evident formality. It was not so. There was smoldering dissatisfaction with the arrangements (accounted for in Section 9.3 below), which erupted four years later, at the 1978 General Assembly.

In connection with the Vancouver Congress it became desirable to change the structure of the Consultative Committee in such a way as further to strengthen the IMU's role. Since 1962, the Consultative Committee had had four members appointed by the IMU Executive Committee, four members appointed by the Organizing Committee of the Congress, and a chairman appointed by the President of the IMU. The $4+4$ formula was understandable in light of the way the international Consultative Committee had come into being (Section 7.4), and it had worked well at the ICMs of 1966 and 1970. For these Congresses, the hosts—the USSR and France—were able to

FIGURE 9.1. Deane Montgomery (1909–1992). American topologist. President of the IMU 1975–1978. Member of the Consultative Committee for the Stockholm Congress 1962, Chairman ex officio of the Fields Medal Committee for the Helsinki Congress 1978. Courtesy AMS.

find four members who complemented well mathematically the four Union members, who could be chosen irrespective of nationality. But it was now realized that very few countries would be in such a position. Consequently, the General Assembly decided that henceforth, the host country would be able to appoint two, three, or four members, the number being decided by the IMU Executive Committee [226].

It turned out later that this decision was a source of difficulties, since national pride was at stake. There was no problem at the ICM-1978, because the host country, Finland, with a population of five million, was so small that the minimum number two was unarguable. In contrast, the views of the IMU Executive Committee and the organizers of the Congresses in Poland in 1982, and Japan in 1990, did not coincide, putting the Executive Committee in an awkward position, as the host countries deserved, of course, the Union's grateful appreciation. In 1987 the Executive Com-

FIGURE 9.2. Jacques-Louis Lions (born 1928). French mathematician (differential equations, control theory). Secretary of the IMU 1975–1982, and President of the IMU 1991–1994. Lions was a member of the Consultative Committee for the Nice Congress 1970 and Chairman of the Rolf Nevanlinna Prize Committee for the Warsaw Congress 1983 and the Zurich Congress 1994.

mittee decided to recommend that the Organizing Committee appoint two members to the Consultative Committee, and the Executive Committee the rest. This proposal was discussed and approved by the 1990 General Assembly. For some reason, the decision was not included in the resolutions. Nevertheless, it has been the rule since the 1990 ICM.

The structural change accepted in 1974 looked small, but it was not insignificant. The Executive Committee obtained more leeway in selecting the members of the Consultative Committee. Hitherto, the Executive Committee had appointed four of them, and actually only three, since the presence of a Soviet member had been regarded as necessary, and so far that member had in practice been chosen in the USSR. Setting up the Consultative Committee now became a more complicated process. The final list of the members of that committee usually emerged after long discussions at a meeting of the Executive Committee, during which many names were

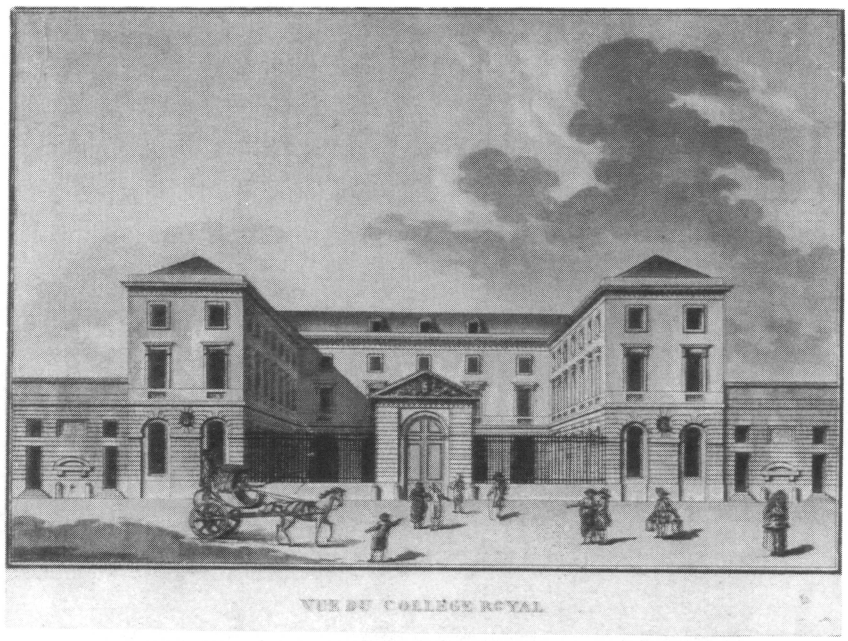

FIGURE 9.3. Collège de France, Paris. In the years 1953–1990, the Executive Committee met fifty-five times in twenty-nine different cities. Paris hosted eighteen meetings, Zurich six, the others at most three each. Collège de France was by far the most popular venue, at least twelve times.

written on the blackboard, quite a few erased, and some written again. All the time, it had to be kept in mind how well the group as a whole covered the various parts of mathematics. Global coverage also had to be taken into consideration. Otherwise, nationality of the candidates played no role.

9.3 ICM-1974 in Vancouver: Disagreement About the Program

During the four-year period between the 1970 and 1974 International Congresses, the IMU followed its now well-established course in the preparation of the mathematical program of the ICM in Vancouver. The Consultative Committee, with L. Hörmander (Fig. 9.4) as Chairman, was elected at the 1971 meeting of the Executive Committee. (For the complete list, see the Appendix, Section 8.)

Pontryagin suggested S.V. Jablonskii as a member, but since he had served on the previous Consultative Committee, the Executive Committee considered it wrong in principle to choose the same person again. Pontrya-

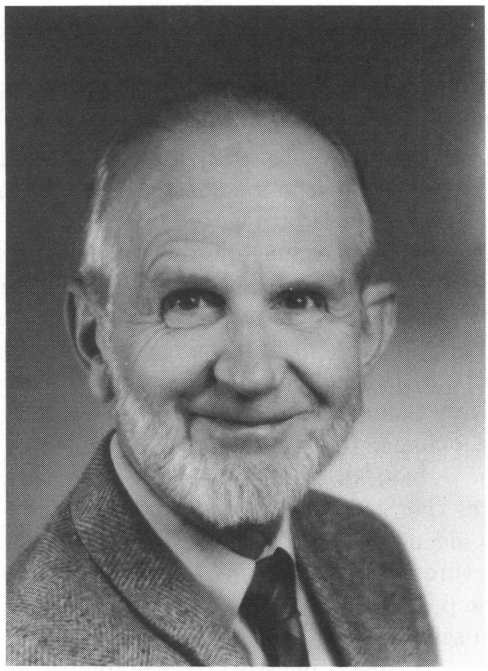

FIGURE 9.4. Lars Hörmander (born 1931). Swedish mathematician (analysis, especially partial differential equations). Hörmander served as Vice-President of the IMU 1987–1990, Member of the Consultative Committee for the Stockholm Congress 1962, and Chairman for the Vancouver Congress 1974. He was a Fields Medalist in 1962 and later served on the Fields Medal Committee for the ICM-1970 in Nice and the ICM-1986 in Berkeley.

gin defended Jablonskii, pointing out that he had served in the previous Consultative Committee only towards the end of its term and that he had energetically secured the participation of about a hundred Soviet mathematicians at the Nice Congress (the Congress report gave the figure 65–70), compared with forty-two in Stockholm, thirty-two in Edinburgh, four in Amsterdam, and none at Harvard. Eventually, Jablonskii was appointed, but the Executive Committee stressed the importance of the principle that no person should serve as member of the Consultative Committee for two successive Congresses [221].

The international Consultative Committees for the ICMs 1962 and 1966 had had some disagreements with the Committee of Soviet Mathematicians, as related above. Now, however, more serious problems arose. The USSR expressed its dissatisfaction with the procedure by which the mathematical program of the Congress was established. The Soviets found that their National Committee was a better authority to judge Soviet mathematics

than the ad hoc international bodies, the Consultative Committee, and the panels.

In the Consultative Committee for the Vancouver Congress, Jablonskii was in continual disagreement with the others. A few months after the first meeting of the Committee in 1972, in Lund, Jablonskii voiced his first strong protest in a letter to the members of the Committee. He claimed that several Soviet mathematicians agreed upon in Lund as members of the cores of the panels were not included in the final list and had been replaced by other names. He recalled that the National Committee of the USSR had recommended the names of Soviet mathematicians to be included in the cores of the panels. As a result of discussions in Lund, a compromise list had been worked out that had been unanimously supported by all members of the Consultative Committee. Now a serious change in the Soviet names had been made, a change that could not be explained by scientific reasons. In this situation, Jablonskii found it necessary to return to the initial recommendations of the Soviet National Committee. The recommendations of the panels could not be the basis for including Soviet mathematicians in the list of lecturers nor in the list of Soviet delegates in Vancouver. In consequence, the participation of Soviet mathematicians at the Vancouver Congress was in severe jeopardy [227].

In his answer, Hörmander, referring to the minutes of the Lund meeting, explained why some new names appeared in the panels. The Consultative Committee had chosen a convener for each panel and authorized him to select for the core of the panel at least two and not more than four of the mathematicians whose names appeared in the list on which the Consultative Committee had agreed. The core of the panel was then required to select jointly additional panel members to bring the total membership up to at least five and not more than eight. These rules did not exclude the possibility for some changes. Hörmander provided statistics to prove that the number of changes in the case of the USSR happened to coincide almost exactly with the average number of all changes. Hörmander called attention to the fact that members of the Consultative Committee were expected to represent the international mathematical community and not any particular national interests. In the Committee they were expected to present their own best scientific opinions, and not decisions made by any other organization [228]. The rift between the views of the Union and those of the Soviet National Committee had now become clearly visible.

After the second meeting of the Consultative Committee, in 1973 in Toronto, where the invited speakers were elected, Jablonskii added a statement to the minutes. After a conciliatory beginning, in which Jablonskii expressed his satisfaction with the "big and constructive work" done by the Consultative Committee, the tone became critical:

> The division into subjects in several cases was unsuccessful....
> The decisions of CC about the speakers from the Soviet Union

> also in several cases were unobjective. It was partly due to the mistakes in the composition of the panels. Several mathematicians from the Soviet Union who have no serious scientific achievements or were the invited speakers at the preceding Congress... were selected by the CC of the Vancouver Congress. From the other side, the mathematicians with new, interesting results, strongly recommended by the leading Soviet specialists, were not included.... Because of the sharp difference between the CC and Soviet mathematical community in the scientific estimation of several mathematicians, the situation can arise that the number of selected speakers will not be supported by the official Soviet scientific bodies—Academy of Sciences of the USSR and National Committee of the Soviet Mathematicians, which is the member of the International Mathematical Union—and will not be included into the Soviet delegation to the Vancouver Congress [229].

The explicit threat of Jablonskii that not all invited speakers from the USSR would be present in Vancouver materialized: Of the forty-one invited speakers from the Soviet Union, twenty-one did not come to Vancouver [230].

At the meeting of the Executive Committee in March 1974, President Chandrasekharan informed the members of Jablonskii's dissent. Chandrasekharan reported that the role of the Consultative Committee had been fully in keeping with the established tradition and entirely in accord with the Working Paper given to the Chairman and Members of the Consultative Committee. He stressed that the number of invited speakers from the USSR not included in the Soviet delegation should be reduced to zero. Members of the Executive Committee, one after the other, emphasized the importance of the National Committees to help invited speakers in their respective countries to attend the Vancouver Congress. Pontryagin took a counteroffensive. He remarked that the General Assembly could discuss the possibility of abolishing the Consultative Committee altogether. Its work could be transferred to the Executive Committee and the National Committees. This proposal found no support among other members of the Executive Committee, and at the end of the discussion, the Executive Committee unanimously resolved not to recommend to the General Assembly the abolition of the Consultative Committee. However, Pontryagin did not forget his motion, to which he returned at the meeting of the 1978 General Assembly [231].

The 1974 International Congress of Mathematicians was held in Vancouver, British Columbia, Canada, during 21–29 August. According to the published record, there were 3,120 registered members, of whom not all attended the Congress in person. They came from seventy countries, with North America dominating: Almost 1,800 participants—that is, al-

most sixty percent—were from the United States or Canada. The Third World was much better represented than at any earlier ICM. For instance, there were fifty-six African mathematicians from fifteen countries.

H.S.M. Coxeter was elected President of the Congress, and R.D. James was Chairman of the Organizing Committee. The main organizer of the Congress at the practical level was Maurice Sion as Chairman of the Local Arrangements Committee.

At the inaugural session of the Congress, Coxeter, in his presidential address, first recalled that an International Congress had been held in Canada almost exactly fifty years ago, which was when the Fields Medals were established.[1] He than called attention to the rapid accumulation of mathematical knowledge.

> To see the extent of the feverish activity, we merely have to measure the volumes of *Mathematical Reviews* on our shelves. The volumes from 1941 to 1951 measure 21 inches, 1952 to 1962, 45 inches, and 1963 to 1973, 87 inches. Thus each period of 11 years produces twice as much as the preceding period. Such a proliferation of mathematical research, if continued in the future, would make the number of writers surpass the number of readers... and all libraries in the world would not suffice to accommodate the mass of material.
>
> However, such a calamity may now have been averted in an unexpected manner. The present generation has been engulfed by a wave of anti-intellectualism.... The idea of "art for art's sake" is less prevalent than it used to be, and pure mathematics is abandoned in favour of applied mathematics, statistics or computing.... What, then, should be our advice to a student who is wondering whether to specialize in mathematics? In view of the present scarcity of suitable jobs, I would advise him to take up some other subject, unless his love for mathematics is so intense that he finds himself doing it in almost all his spare time, even thinking about it while sleeping, or between dreams. For such a person, as Hermann Minkowski declared, "The purpose of life is to behold the truth, to understand it well, and to expound it perfectly."

Before Coxeter gave the floor to Chandrasekharan, who was scheduled to speak as Chairman of the Fields Medal Committee, an unprogrammed break was announced. Much later, Sion told me the reason. No one had remembered to take the Fields Medals from the safety deposit box at the bank where they were being kept. The bank was not near the Queen Elizabeth Theatre, where the opening ceremonies were taking place, and in

[1]This is true if the statement is broadly interpreted. The formal Canadian decision concerning the medals was made in 1931 (Section 3.1).

spite of the help of a police escort, it took some time to pick up the medals. For the organizers the pause was probably much more painful than for the others, who hardly took notice.

Chandrasekharan announced that the Fields Medal Committee had decided "at the outset, and not without discussion, to confine the award to mathematicians under forty, as in the past. We are convinced that the two selected are mathematicians of exceptional merit, whose work has advanced the development of important branches of our science.... They are, in alphabetical order, Enrico Bombieri and David Mumford."

That same evening, reports on the work of the Fields medalists were given. Chandrasekharan, who spoke of the work of Enrico Bombieri (University of Pisa, Italy), said, "Bombieri's work ranges over many fields: number theory, univalent functions, several complex variables, partial differential equations, algebraic geometry." The work of David Mumford (Harvard University, USA) was then presented by John Tate: "Mumford's major work has been a tremendously successful multi-pronged attack on problems of the existence and structure of varieties of moduli, that is, varieties whose points parametrize isomorphism classes of some type of geometric object. Besides this he has made several important contributions to the theory of algebraic surfaces."

All mathematical activities of the Congress took place in the buildings on the campus of the University of British Columbia, where most of the Congress participants were accommodated in dormitories. This contributed to the feeling of togetherness, and the sunny weather was perfect. In Nice, the big hall for plenary lectures had not been satisfactory from the point of view of hearing and seeing. The Canadians had adopted a different solution. The largest auditorium, offering a good seat to everybody, had a capacity of not much over four hundred. This was, of course, far too small, but the idea was to use television and make it possible to watch the events of the Congress all over campus, in the lobbies of the dormitories, for example. There were mixed feelings about this procedure. In spite of the convenience it offered, a good number of participants would apparently have preferred to be present on the spot where the action was taking place.

At the closing session, Chandrasekharan, as President of the IMU, presented the customary report on the activities of the Union. He concluded his address by saying, "The Congress has brought together mathematicians from many lands, united in a friendship which stems from a common devotion to mathematics, transcending the stresses of politics, and happily free from the strains of competitive sport. We trust that the next Congress in 1978 will be a worthy successor. May I, as Chairman of the Committee to select a site for the next Congress, request you, Mr. President, to invite Professor Rolf Nevanlinna to speak on behalf of the National Committee for Mathematics in Finland." Nevanlinna's invitation to the next International Congress of Mathematicians in Helsinki was accepted by acclamation [232].

The Congress had not forgotten J.C. Fields and his Medal. The Organizing Committee decided in December 1976 that all remaining funds held by it arising from the Congress be transferred to the University of Toronto for the purpose of providing out of its income additional financial support for the Fields Medals [233]. "The International Mathematical Congress Awards Fund" thus established signified an essential increase to the funds backing the Fields Medal.

All funds associated with the Fields Medal—from the 1924 Toronto Congress, from the estate of Professor Fields, and from the 1974 Vancouver Congress—are held in trust by the Board of Governors of the University of Toronto. Following a proposal from Toronto, the Executive Committee of the IMU agreed in 1983 that all these funds should be combined into one capital account, which was established in May 1983 [234]. One year later, the Canadians informed the Union about complications with the Governing Legislation of Ontario [235]. In plain language, the report meant that surplus income could not be accumulated as before and must be distributed.

As a result of these developments, it became possible to award more than two Fields Medals at a Congress if such was recommended by the Fields Medal Committee (yet not more than four) and to raise considerably the amount of the cash prize. Before 1983, the cash prize had been 1,500 Canadian dollars. For the ICM-83 it was doubled, for the ICM-86 it was doubled again, and for the ICM-1990 it was raised from 6,000 to 15,000 Canadian dollars per Medal.

9.4 How to Make an ICM

Is this section is presented an account of the organization of the ICM-1978 in Helsinki [236]. Owing to my involvement with the arrangements, this section is strongly personal and has the character of an essay, especially if combined with the associated notes [236]–[240]. As for its inclusion here, I felt that even though the 1978 Congress was just one in the long series of ICMs, the problems concerning the arrangements are rather similar everywhere. Besides, the case of a small host country may be of interest in the light of what Hodge said at the ICM-1954: "If the complexities and cost of organisation continue to increase, it will become more and more difficult to find countries able and willing to undertake the burden of arranging a congress, and eventually there might be only one or two of the few remaining rich countries able to do so. There can be no doubt that this would be very bad for mathematics."

Thanks to Rolf Nevanlinna's reputation and personality, his invitation to the 1978 International Congress of Mathematicians in Helsinki was accepted with exceptional enthusiasm by the Vancouver Congress. In reality, the decision in favor of Helsinki had been made years before.

The first contact between the IMU and Finland concerning the organization of an ICM took place as early as 1969, before the Nice Congress, as related in Section 8.4. The letter to the Finnish National Committee for Mathematics was signed by President Cartan, but it is not unlikely that Chandrasekharan, who was a member of the Executive Committee, had a word to say about this approach. At any rate, as President of the Union from the beginning of 1971, Chandrasekharan lost no time in expressing his wish that Finland host the ICM-1978.

In order to form a preliminary picture of what the ICM in Helsinki would mean, I drafted with my colleague I.S. Louhivaara a Congress program, as complete and detailed as possible, and once this was done, a budget. This was, of course, an ambitious undertaking. But we thought that such an imaginary Congress would be a useful basis for further discussions. In retrospect, many details of our paper were wrong, but the overall picture was not so bad. One general line of action was crystallized. In order to balance the budget, it was essential to have low labor costs, i.e., to have a good part of the required work performed voluntarily, without pay, by mathematicians. On the income side, we could not count too much on membership fees, which traditionally had been very moderate, nor could we rely on much generosity from the private sector.

Four conditions should necessarily be fulfilled: some financial guarantee from the Ministry of Education, good cooperation with the University of Helsinki, securing hotel accommodations in all price categories for 4,000 people, and wholehearted participation in the organizational work by the Finnish mathematical community, particularly by the staff of the Department of Mathematics at the University of Helsinki.

The validity of the first two of these conditions was easy to verify. The Ministry of Education declined to give any concrete promise in written form so early, but they said that a Congress of this magnitude and importance would certainly be under their protection. (The promise was well kept.)

At the University of Helsinki, in its central buildings, we wanted to have during the Congress (which was vacation time) at our sole disposal all large lecture rooms and a good number of others, almost all the restaurants, much office space, and so on. Some cautious administrators felt that such far-reaching promises should not be made seven years in advance. But the Rector silenced them brusquely and assured me that the Congress would be a top priority for the University [237]. At that stage I did not yet fully realize how important the aid of the University was going to be. Not only did it provide, practically free of charge, the needed premises, often repaired and repainted, as well as all sorts of equipment, but also a large number of professional people—from the Technical Department, the Treasury, and the Public Relations Office, as well as legal advisers—all of whom helped us before, during, and after the Congress.

It was time-consuming but not too difficult to convince ourselves that all Congress members could be accommodated. Preliminary reservations were

made, even though the question of whether Finland would be willing to host the Congress was still open. This we did not tell to the hotels.

There began informal preliminary discussions about the Congress among mathematicians in Finland. The average initial reaction was positive skepticism. "Why not, but...." Clearly, the matter should not be pressed unduly. But it matured in the positive direction. I began to feel that the Congress was being seen as a common cause for Finnish mathematics and that a good number of colleagues were willing to work for it. Chandrasekharan was informed that Finland was prepared to host the 1978 Congress.

Preparations were now undertaken more seriously. Formally, the organization of the Congress was under the auspices of the Finnish National Committee for Mathematics [238]. It appointed an Organizing Committee, whose composition was the result of extensive informal discussions. It was felt that I should carry the prime responsibility, and so I became the Chairman of the Committee.

We decided to take advantage of the forthcoming 1974 Congress in Vancouver. A working team was set up, where each member had the task of finding out during the Congress how the Canadians had arranged matters in a particular area. Referring to Chandrasekharan's recommendation, I asked the chief organizer, Sion, for his understanding and cooperation. He and his staff were very helpful, considering the pressure under which many of them worked during the hectic days of the Congress. Later, we invited Sion to visit Helsinki, so we could obtain his advice and opinions on our preparations.

This Canadian–Finnish cooperation, which facilitated our work greatly and probably saved us from many mistakes, was a new feature: The Canadians had not been much in contact with the French organizers, nor the French with the organizers in Moscow, and so on into the past. Much later, during this writing, I noticed what the first ICM in Zurich in 1897 had resolved. Of the four purposes of the Congress, number three had been "to advise the organizers of the future Congresses." Ignorant of this in 1978 but feeling that the debt of gratitude towards the Canadians had to be compensated, we volunteered to send to the Polish organizers of the ICM-1982 a sample copy of all documents we had prepared for the Helsinki Congress. We were pleased to see that they adopted large portions of our texts. Some Helsinki texts have even become standard, having appeared in the papers of the ICMs 1986 (Berkeley), 1990 (Kyoto), and 1994 (Zurich). The old Zurich stipulation of 1897 is still alive.

During the Congress in Vancouver, as soon as the Site Committee had made their decision [239], I was summoned and had to give a solemn promise before the Committee that the Helsinki Congress would observe the ICSU principle of free circulation of scientists. Even though it is not in the power of mathematicians to see that the principle is upheld, such a pledge is not without importance. Knowing what lay ahead, I had been in contact with the Ministry for Foreign Affairs in Helsinki. They were

aware of the ICSU principle and authorized me to give the agreement. I thought that in the case of Finland, where the cornerstone of foreign policy is to maintain friendly relations with all countries of the world, my promise would be a sheer formality. But unexpectedly, problems arose with the Republic of South Africa, and the ICSU principle was put to use, as will be related soon.

Lack of funds forced us to do most of the organizational work "ourselves," to a great extent without salaried help, and almost entirely without resorting to professional agencies. In a way, I was pleased with this, hoping that a warmer and more familial atmosphere could thereby be achieved. An exception was the agreement we concluded with the Travel Agency Area (a daughter company of Finnair), which was to take care of all the arrangements related to lodging. At that time it was possible to negotiate a contract by which Area did not charge the Congress for their work. Their profit came from the commissions travel agencies received from the hotels. They never revealed how much this was, but from the fancy dinner to which Area invited me after the Congress, I concluded that they must have been satisfied with the deal. Since the Congress had the right to keep track of the work that Area was doing, we could see what a tremendous amount of work we saved by avoiding correspondence with the hotels' customers.

At the time of the Congress, around three hundred people, none of whom had been in any contact whatsoever with the organizers, walked into the Congress Bureau demanding this and that sort of accommodation. In high-season Helsinki, when hotels are practically full, Area's help came to good use. Not only that, Area was instrumental in saving the Congress from a veritable disaster. No matter how careful the planning, Congress organizers can get into nightmarish situations. In the 1970s, the big summer event in Helsinki in even-numbered years was the Finland–Sweden Track and Field Meet. It drew a full stadium—about 40,000 spectators—and received a large amount of publicity. It was held during two days, usually in August. When the dates for ICM-1978 were fixed in 1971, I informed the organizers of the sports event, who promised to see that no overlapping of the days would occur. But I was too early, and they forgot all about their commitment. Their dates were publicized with much ado, and the collision was there. Very soon they noticed what the overlap meant, as they had difficulty in obtaining rooms in most hotels; in 1978 the hotel capacity in Helsinki was much lower than what it is today. Otaniemi, where the athletes used to stay, was reserved for the IMU General Assembly. Even at the Olympic Stadium, a number of rooms needed for the big meet were reserved for Congress members who had asked for rooms at the lowest possible price. At first, the all-powerful sports people tried to wipe out the Congress's reserved accommodations. But Area refused to revoke our reservations, pointing out that this was not a case of force majeure, and even less so, since the Congress had given a warning years ago. The unbelievable

happened: The Finland–Sweden Meet had to bow, and they changed their dates.

Another serious incident was caused by the Minister of Education. A phone call from the Ministry let me know that the Minister would not tolerate the presence of South Africans at the Congress. More precisely, he felt obliged to consider withdrawing the Ministry's financial support unless the invitation to South African mathematicians were canceled. This was a serious matter, and I made it very clear to the highest officials of the Ministry that the Minister obviously did not know of what he was speaking. I explained to them why breaking the principle of the free circulation of scientists would be impossible. Not only did I have to obey it, having given my word on it in Vancouver, but the same was true of the Republic of Finland, which had joined ICSU. I never heard of this threat again. But the Minister was a man of principle. At the time of the Congress, he staged an individual demonstration, fortunately quite harmless (Section 9.6).

Instead of a "Program for Accompanying Persons," we decided to have a "Social Program." The idea was to make this an essential part of the activities of the Congress, giving opportunities for informal exchanges of ideas and for making new acquaintances and deepening old ones. It was thus meant for all Congress members and to be free of charge. This was in conformity with the "Hurwitz spirit" of the ICM-1897: "May the inspiring force of personal communications show its existence in these days.... May the relaxed, cheerful sociability give us delight" (Section 1.2).

In planning the program, it was necessary to have an estimate for the total number of participants. As a rule, we used the figure 4,000. This followed Sion's advice: In arranging various events, try to make a realistic estimate. Be prepared for a little more, but do not exaggerate, because you may then lose many possibilities.

In many arrangements, we encountered the advantages and disadvantages of being a small country. The advantage was that the Congress was regarded as an important event, and not only among academic people. The disadvantage was that in 1978, Helsinki was in some respects too small for a Congress of 4,000. But when positive confronted negative, the positive aspect usually prevailed, and the problems could be surmounted [240].

On the Sunday in the middle of the Congress, the members were offered either a twelve-hour excursion by bus to Turku, the ancient capital of Finland, about 160 kilometers from Helsinki, or a four-hour cruise in the Gulf of Finland. It was difficult to predict the distribution of preference between these alternatives, but it turned out to be almost exactly fifty–fifty. The duration of the ship cruise was determined by the time the big ships between Helsinki and Stockholm usually lay in the Helsinki harbor. In order to be on the safe side and have more comfort, two ships were reserved, belonging to different companies. After much persuasion, one of the companies, the Silja Line, provided the boat for the Congress at a very low price. Here, as well as on some other occasions, the commercial company was impressed

to hear that the people in charge of the Congress preparations and a good part of the working personnel were unpaid volunteers from the University. Still, we had to appeal to patriotic feelings, to the great advertising value of the cruise for people who teach tens of thousands of prospective tourists, and so on, before the desired decision was reached. With the other company we were not so successful, despite our being able to refer to the generosity of its competitor.

The excursion by buses offered an interesting problem for the planners. About forty buses were needed. Their departure from Helsinki was carefully planned to maximize the convenience of the passengers, who came from different hotels; to minimize traffic problems on the highway; and to avoid jams in Turku in the scheduled tourist sites and restaurants. The plan was complicated, but it worked well. I wonder whether professional travel agents could have beaten this mathematically tailor-made scheme.

The Organizing Committee had no planned mode of action. It met rather often in the beginning, when the Congress program was not yet set, and only seldom later. Whenever an item of the program was more or less fixed, a responsible person was appointed to supervise the execution of the needed measures. Such "local chiefs" had extensive powers in their respective areas, reporting, if the occasion demanded, directly to me. In most cases, this model of administration worked well. It was flexible, unnecessary meetings were avoided, and there was no hierarchy among the local chiefs, who were almost all from the Department of Mathematics of the University of Helsinki. Its drawback was that too much depended on the chairman. It was not meant to be so: my colleague Louhivaara should have been the Secretary General. But having been elected Rector of the University of Jyväskylä, in Central Finland, and having later accepted a professorship at the Free University of Berlin, he was not available. Usually, I had no difficulty in finding colleagues for responsible tasks, but after Louhivaara declined, nobody was willing to assume the post of Secretary General.

A special position was occupied by Rolf Nevanlinna, the grand old man of Finnish mathematics. In the process of fundraising, he was indispensable with his prestige and network of important connections. It would have been a matter of course to elect Nevanlinna President of the Congress. But he declined: "I want to feel relaxed, no obligatory speeches...." Thus he became the Honorary President.

Since preparations had begun early, before the formal decision in 1974, we had for a long time the feeling that there was plenty of time, and the office of salaried secretaries could be kept minimal. We knew that there was a time-honored timetable for sending out Announcements of the Congress, which largely determined the pace of the preparations: A preliminary Announcement two years prior to the Congress, the First Announcement about a year before, the Second Announcement towards the end of the preceding year, and the Third Announcement as soon as the mathematical program was final, in our case in the spring of 1978. Of these, the Second

Announcement was the main publication, providing practical information about Helsinki and a detailed description of the Congress activities. It also contained instructions about short communications and a registration form, with the request that the form be returned as soon as possible.

The Second Announcement was dispatched in several thousand copies in November 1977. The voluminous Announcement plus the attached tourist material made an impressive package. Finnair had promised to mail them for us, free of charge. (A tip had been obtained from Sion, who had persuaded Air Canada to do this for the ICM-1974.) Having seen the sizable van full of our envelopes, the Finnair people held an emergency meeting. A post office did the mailing; the bill went to Finnair.

The registration form was prepared in cooperation with Area. For us, members of the Congress were colleagues, whereas for Area they were customers. Area aimed at safeguarding the interests of the organizers. In my opinion they did not sufficiently take into consideration that local bureaucracies often prevented people from Socialist or Third World countries from registering early. Since it was precisely these people who could least afford higher rates, I was more reluctant than Area to introduce efficient sanctions. A compromise was made: the membership fee was $60 if paid before 15 May 1978, otherwise $70; for accompanying persons there was only one rate, $35.

The Union's funds for travel grants for young mathematicians from developing countries or from countries with severe currency regulations had increased, so that forty-seven grantees could be selected. In the course of the correspondence with them we noticed that many of them still would have difficulties if only their travel costs were paid. We decided to waive their membership fees and, thanks to the Finnish development agency FINNIDA, we were able to offer them free accommodation. The 1978 IMU General Assembly, besides extending thanks for this to the Finnish government and the Organizing Committee, expressed the hope "that similar actions will be taken by the authorities of the country where the next ICM will take place" [241]. This was indeed done at the Warsaw ICM, and the arrangement has become a well-established rule, followed at all ICMs since 1978.

At an early stage, a decision was made about the theaters of the Congress. The idea to concentrate everything at the University of Helsinki, much as we had liked it, had to be abandoned, because even the largest hall or lecture room there would have been too small. The opening and closing sessions and the plenary lectures would be held at the Finlandia Hall, all other mathematical activities at the University. A similar pattern was adopted at the Nice ICM, in 1970, and later in Zurich, in 1994.

The Finlandia Hall, designed by Alvar Aalto and inaugurated in 1972, is a concert and conference building. It is centrally located, within walking distance from the University and the downtown hotels. The great concert hall has 1,700 seats. We knew that this was not enough for the opening ceremonies, but we estimated that it would suffice for the other occasions.

At any rate, television monitors would be available in the spacious lobbies of the building, and for the opening session there would be a big screen as well.

For the plenary lectures, the room proved large enough, with one exception. André Weil's address "History of mathematics: why and how" was so popular that some latecomers had to follow it from the TV in the lobbies. With more than 3,000 mathematicians present, the conclusion was that of the fifteen plenary lectures given, fourteen drew an audience of not more than fifty percent of the Congress participants. The television sets were favored by some during all the plenary lectures, but not by many. A typical situation was a group of a few people chatting while watching the lecture on TV.

The concert hall created some problems. Blackboards could not be used, and the experiments with transparencies revealed that for the text to be seen from the back rows of the balcony, unusually large writing was required. For this reason, special transparencies were made on which thin horizontal lines indicated the size of the letters to be used. Plenary speakers were informed about this, and they were invited to a brief rehearsal before the lecture to practice correct-sized writing. In view of the importance of these lectures, we found it imperative to make sure that the audience could see and hear them well.

It would have been easy to display the flags of all countries with participants in the Congress, since the city provided such a service. Yet we refrained from it, because the costs would have been disproportionately high and because problems could have arisen for political reasons, in the case of China, for example. Since an ICM is a gathering of individual mathematicians, not of countries, it was even proposed that the name of the country be removed from the name badge. This we did not do, nor has it been done by any other Congress organizers.

In the main venue, the University of Helsinki, the Congress could profit from the University's historical tradition. According to the ideology of the early nineteenth century, the University was to be one of the three important buildings of the new capital, Helsinki.[2] (The other two were the Lutheran Cathedral and the Government Building.) Consequently, the Main Building of the University and the Library rose in the very center of Helsinki, and a number of other University buildings would later be constructed in their immediate neighborhood before the area became congested. Thus the core of the University is located not only in the administrative center of Finland, but in the main shopping and business region of Helsinki as well. Except for the airport, all imaginable services are within easy walking distance. In the middle of this compact hub, the lecture rooms,

[2]The University was founded in 1640 and moved from Turku to Helsinki in 1828.

ICM office, book exhibition, post office, bank, travel agency, and medical center were all close to each other, in academic surroundings.

9.5 The 1978 General Assembly in Finland

In June 1975, between the 1974 and 1978 General Assemblies, Vice-President Miron Nicolescu suddenly died [242]. As Vice-President for the remaining part of Nicolescu's term, the Union elected G. Vranceanu, from Romania.

The eighth General Assembly of the International Mathematical Union was held in Otaniemi, Finland, during 11–12 August 1978. Otaniemi lies just outside the city limits of Helsinki, about 10 kilometers to the west from its center. The venue was the campus of the Helsinki Technical University, where the meeting took place in the conference building Dipoli. Most delegates stayed near Dipoli in student dormitories, which were converted to a hotel during the summer vacation [243].

The membership of the Union had risen to forty-seven, which was five more than at the time of the General Assembly in Harrison Hot Springs, in 1974. All new members were countries from outside Europe: three from Asia (Iran, the Philippines, and Singapore) and two from Africa (Cameroon and Egypt).

With all ten members of the Executive Committee and national delegates of forty countries present, the Assembly was the largest so far. In addition to standard issues, the two main items of the 1978 General Assembly were mathematics in developing countries and the program of the ICMs, to whose planning the USSR had proposed essential changes.

In his opening address, President Montgomery called attention to the increasing role of developing countries in mathematics. The important meeting held in Rabat, Morocco, in 1976, was supported by the Exchange Commission of the IMU, whose Canadian Chairman, A.J. Coleman, had negotiated grants from the Canadian development agency CIDA. The African Mathematical Union was founded there, and Montgomery welcomed its President Hogbe-Nlend (the delegate from Cameroon) and Vice-President Ashour (the delegate from Egypt), both present in Otaniemi. Montgomery also thanked those who had contributed to the Canberra circulars, especially B.H. Neumann (a delegate of Australia). "These letters help in the development of mathematics in Southeast Asia."

He then proceeded by pointing out that the Executive Committee was proposing a new reinforcement of the Exchange Commission. More precisely, the Assembly should consider the revision of the terms of reference of the Commission on Exchange (and possibly a change of title) so as to further the work of the Union in relation to Development.

A Working Group was appointed whose proposals were accepted subject to minor modifications. The General Assembly resolved to establish a Commission on Development and Exchange, to "support and encourage the growth of Mathematics in developing countries and co-operate with appropriate bodies to that end. The Commission shall come into existence on 1 January 1979, and the present Commission on Exchange shall be dissolved from that date" [241].

This was a major decision of the 1978 General Assembly. In addition to ICMI, the Union was now going to have another important subcommission. Section 11.3 is devoted to an account of its activities during 1979–1990.

The dues were not raised. For the period 1979–1982 the General Assembly authorized an annual expenditure of 61,250 Swiss francs for administration and 98,750 Swiss francs for mathematical activities. (Cf. the Appendix, Section 12.)

Of all the General Assemblies since 1958, I found the atmosphere in Otaniemi the tensest. Heated discussion was carried on about the selection of invited speakers for the ICMs. Pontryagin, on behalf of the USSR delegation, said that the organization of the ICM should be changed so as to give a much more important role to the National Committees. Several delegates objected to this viewpoint. In particular, some delegates from small countries and from developing countries felt that a change of this kind in the method of selection would not be appropriate for mathematicians in their countries. In the course of discussion several texts of resolutions were proposed, coming both from the floor and from members of the Executive Committee. Finally, the following resolution was accepted:

> The General Assembly authorizes the next Executive Committee to study effective ways to further improve the system of selection of invited speakers to the ICM. To this end, the National Committees are invited to send in writing detailed proposals, remarks, and comments to the Secretary of the Union, within the next year. Any recommendations by the Executive Committee resulting from this study shall be submitted for approval to the member countries of the Union.

An account of the consequences of this resolution will be given in Section 10.1.

From time to time, the 1978 General Assembly resembled a political forum. The discussions related to developing countries had tones unfamiliar to meetings of mathematicians. Prior to the elections, a candidate from the floor to the IMU Executive Committee made a speech praising himself. This was very much in contradiction to "Cartan's Rule": "A person indicating desire to be elected to an administrative body of the Union should be excluded forthwith." A few other speeches followed, somewhat in the same vein. But these interpolations led nowhere. The slates proposed by the Nominating Committee were all accepted by majority.

The General Assembly elected the following Executive Committee for the IMU for the four-year period beginning on 1 January 1979:

President: L. Carleson (Sweden)

Vice-Presidents: M. Nagata (Japan), Yu.V. Prohorov (USSR)

Secretary: J.-L. Lions (France)

Members: E. Bombieri (Italy/USA), J.W.S. Cassels (U.K.), M. Kneser (Federal Republic of Germany), O. Lehto (Finland), Cz. Olech (Poland)

Past President: D. Montgomery (USA), ex officio

The new President, Lennart Carleson (Fig. 9.5), had been an active promoter of cooperation between the IMU and the 1962 Stockholm Congress. Hassler Whitney became the President and Peter Hilton the Secretary of ICMI. As Chairman of the new Commission on Development and Exchange, the Assembly elected Henri Hogbe-Nlend.

The Site Committee for ICM-1982 under the chairmanship of President Montgomery held its only meeting right after the General Assembly had been closed, to discuss the proposals for the ICM-1982 by Argentina, the Federal Republic of Germany, Israel, and Poland [241]. Initially, the German proposal to hold the ICM in Hamburg had come from a commercial firm, and German mathematicians at first took a negative stand. Later, they changed their minds, and an official invitation was received from the German National Committee. Yet this prehistory may have been the reason why Hamburg was eliminated at an early stage, together with Mar del Plata, Argentina.

The choice between Jerusalem and Warsaw turned out to be problematic. Both places were described favorably. Nevanlinna was explicitly in favor of Jerusalem. Vladimirov, on the other hand, vigorously opposed it. Referring to the unstable political situation in the area, he said that only very few Soviet mathematicians would attend the Congress if it were held in Jerusalem, perhaps none. In contrast, Polish mathematicians would be their friends, and to friends they would come by the hundred, the number could be three hundred or more. I then heard myself interjecting: "Too bad that we Finns are not your friends." (The big disappointment of the Helsinki Congress was the low attendance—some fifty—from the USSR; more will be said of this later.) After a long discussion, the opinion prevailed that Warsaw was a safer place for the ICM than Jerusalem. Some members may also have thought that the endangered East–West cooperation should not be further jeopardized, but such views were not voiced.

Czesław Olech, the newly elected member of the IMU Executive Committee, was summoned, not only to hear the good news but also to be informed of the regulations to be followed in arranging the Congress, ICSU's

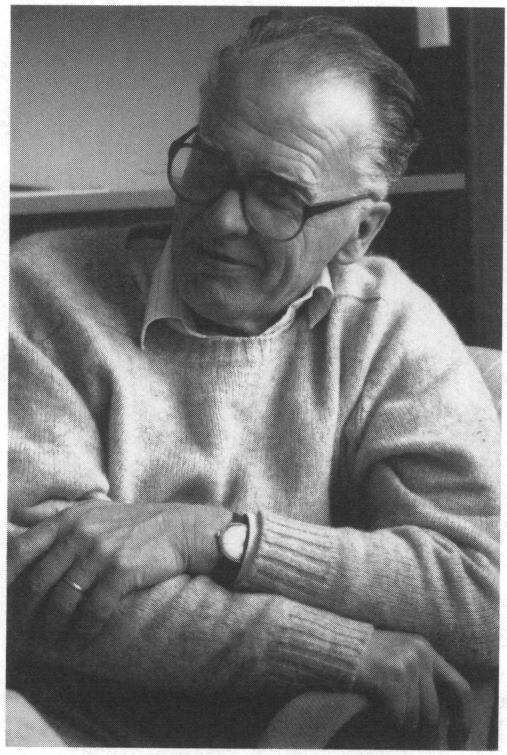

FIGURE 9.5. Lennart Carleson (born 1928). Swedish mathematician (harmonic and complex analysis). President of the IMU 1979–1982. Member of the Consultative Committee for the Stockholm Congress 1962 and of the Program Committee for the Berkeley Congress 1986. Member of the Fields Medal Committee for the Helsinki Congress 1978 and ex officio Chairman for the Warsaw Congress 1983. He stressed the Union's obligations towards applied mathematics.

nondiscrimination principle, and the IMU's rules concerning the preparation of the scientific program. This discussion, which explicitly obligated the Warsaw Congress to observe the conditions of the Union, was probably to Olech's benefit when difficulties were later encountered.

9.6 ICM-1978 in Helsinki

The first step towards the mathematical program of ICM-1978 was taken at the meeting of the Executive Committee in Paris in May 1975, where Montgomery made his debut as President of the IMU. By the rules of the Union, he alone was authorized to appoint the Chairman of the Consultative Committee. In a quiet voice he said that in his opinion, Armand Borel

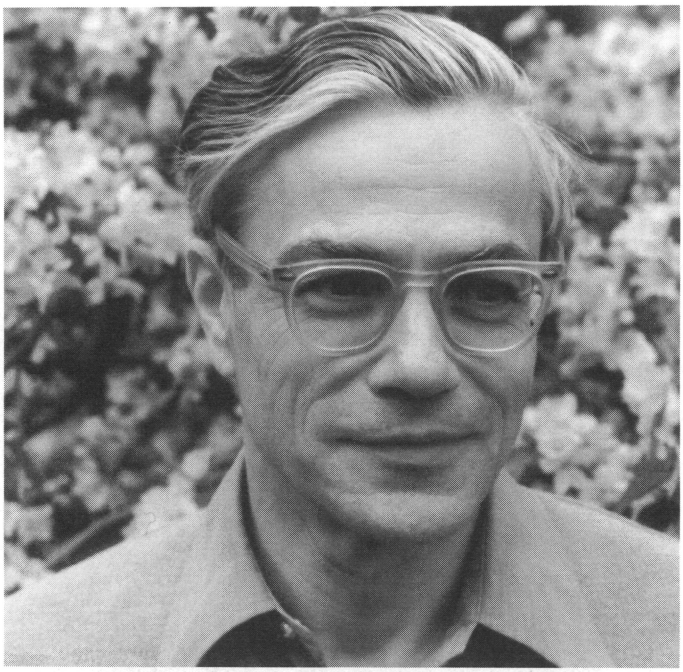

FIGURE 9.6. Armand Borel (born 1923). Swiss–American mathematician (Lie algebra, topology). Member of the Consultative Committee for the Moscow Congress 1966 and Chairman for the Helsinki Congress 1978.

(Fig. 9.6), from the Institute for Advanced Study, Princeton, would make a good Chairman. Pontryagin responded vigorously, pointing out that it would not be proper to have the President of the Union and the Chairman of the Consultative Committee from the same Institute. He proposed that the Chairman should be from Japan. Some discussion followed, during which Montgomery did not utter a word. When he decided that enough had been said, without raising his voice or giving any explanations, he appointed Borel [244].

At the first meeting of the Consultative Committee, held in Helsinki in June 1976, it was agreed that there would be about 16 one-hour lectures, which, as in the past, should be broad surveys for a wide audience. There would be about 120 forty-five-minute lectures, divided up into nineteen sections. Although more specialized than the one-hour addresses, these lectures should also be broadly conceived, not necessarily limited to the work of the speakers, and be at least partly accessible to nonspecialists with closely related interests. Nominations were made for the members of the panels, and the approximate number of the speakers in each section and the number of suggestions requested from each panel were fixed [245].

After the panels had worked for a year, the Consultative Committee made final decisions at its second meeting, in Paris, in October 1977. As a rule, recommendations of the panels were followed, but from time to time, disagreement arose about the invitees. With painstaking care, Borel then tried to arrive at a decision agreeable to all. The telephone was used for additional last-minute information; voting was rare. When the list was finally completed, after three long days, S.M. Nikolskii, the Soviet member, thanked the Chairman for his competence and impartiality. He said that he would do his best to secure the presence in Helsinki of all invited speakers from the USSR. The state of affairs looked much better than it had been before the Vancouver Congress four years earlier. In reality, there was to be no improvement.

Rumors about Soviet dissatisfaction started to circulate in the spring of 1978. In Helsinki we received from time to time estimates about the size of probable Soviet participation in the Congress. The figures began to go down. At the meeting of the Executive Committee in Paris in May 1978, Pontryagin said that the Helsinki Congress was very unpopular in the Soviet Union. He criticized the choice of invited speakers, expressing dissatisfaction with Nikolskii, who had worked in the Consultative Committee as an individual, with the result that the point of view of the Soviet National Committee had not been correctly presented. During the joint luncheon of the Executive Committee, a veritable clash occurred. Pontryagin knew that one of the Fields medalists was G.A. Margulis, from the USSR, and he was furious about this choice. He let it be understood that it was a shame for the Union and for the Fields Medal Committee to have selected as a winner a second-rate mathematician like Margulis. If Pontryagin spoke with force, the answer he received came with equal vigor. The essence of what Chandrasekharan said was that while it might not be absolutely certain that the Committee had found the four most deserving medalists, it was absolutely certain that the mathematics of all those selected was of the highest quality and deserved profound admiration. Pontryagin, realizing that Chandrasekharan had the full support of all the others present, did not continue the debate. There was general concern that if Pontryagin's behavior reflected the views of the Soviet mathematical establishment, the prognosis for the ICM-1978, and more generally, for future East–West mathematical cooperation, was not good.

In the years 1975–1978, Chandrasekharan, more than the others, formed a counterweight to Pontryagin in the Executive Committee. At the 1977 meeting of the Executive Committee, when Pontryagin had been exceptionally aggressive, Chandrasekharan retorted that the IMU had lived without the Soviet Union before and could live without it in the future. There was no time for the tension to mount, because Pontryagin retreated immediately. After all, the IMU was deemed important for Soviet mathematics.

The International Congress of Mathematicians in Helsinki was held during 15–23 August 1978. The total number of ordinary members present

was, by the "official" statistics, 3,042. A careful counting of the participants was maintained almost to the very end, but not quite. Owing to more urgent business during the days of the Congress, it was not possible to check with certainty that every one of the 3,042 was present. However, any error represents a negligible quantity.

The largest national contingents were those of the USA 612, France 281, Federal Republic of Germany 261, Finland 223, Japan 192, U.K. 173, Canada 138, and Poland 119. In all, there were participants from eighty-five countries, plus seven members without nationality. If accompanying members are included, the participation was almost exactly four thousand [246].

The Poles came to Helsinki by a boat that they had rented for their exclusive use. During the Congress, it stayed anchored close to the University, and, being in harbor for noncommercial purposes, at a low cost. Thus it offered convenient accommodation. But more than that, the Poles had taken with them ample stores of food and liquor, and there was an orchestra on board. Invitations to Polish parties soon became a coveted privilege.

A particular attraction of the Helsinki Congress would have been numerous attendance from the USSR. During early 1978, reports from the Soviet Union still indicated a participation of two to three hundred. In Helsinki we received letters from Soviet mathematicians who were eagerly looking forward to this chance to meet colleagues from other countries. They even expressed the idea of assembling Soviet mathematicians in great numbers in Leningrad and holding a post-Congress meeting there.

All this came to naught. The Soviet group in Helsinki consisted of not more than fifty-five mathematicians, which was about the same size as in Vancouver. Of the twenty-eight invited Soviet speakers who had answered the invitation in the affirmative, only fourteen were present. Absent was also the Soviet Fields Medal winner A.G. Margulis. During the Congress, I was told by a Soviet participant, an academician, that Margulis was prevented from coming to Helsinki not by state authorities, but by a board of mathematicians that recommended that he not be granted the required permit. The partial boycott on the part of the USSR was a great disappointment to the Congress.

It was agreed that at the opening session, the Minister of Education should welcome the Congress on behalf of the Finnish Government. Having heard that mathematicians from South Africa would be present, he declined to come. His decision was leaked to the press, with the result that the Congress received more publicity than would otherwise have been the case. Although Finland had assumed a sharp attitude against apartheid, the newspapers were overwhelmingly of the opinion that the Minister had misbehaved in refusing to extend greetings to the Congress guests.

At the proposal of Montgomery, I was elected President of the Congress and Nevanlinna Honorary President. In my address, I began by saying that "this is a gathering of one huge mathematical family and not of delegations or representatives of countries." I wanted to stress this ideology; in

earlier Congresses even royalty had sometimes been represented as well as governments, not to speak about universities, academies, and various other scientific bodies.

I then spoke about the scope of the ICMs.

> A careful analysis of the reasons for holding ICMs not only serves as a motivation for the fairly difficult and expensive organization. It is also required if we wish to preserve the present character of these congresses. The mathematicians form a big active group, and it is only natural to try to associate all sorts of activities with a gathering as important as an ICM. No matter how important such activities are as such, and some clearly are, like promoting mathematics in developing countries and various questions related to the teaching of mathematics, at an ICM they can only play a secondary role, subordinate to the official mathematical program.

Of the part of the IMU in the preparation of the mathematical program, I said:

> Well over a hundred of the world's leading mathematicians are involved in the work, the panels make proposals about invited speakers, and the Consultative Committee creates the final list. In my opinion, this international cooperation, which goes on for two years in each four-year period, is very important for our science as such, and I cannot see any essentially better procedure for a neutral and authoritative appraisal of current mathematical research.

I felt obliged to give the Consultative Committee its due credit: "Its foreign members went far beyond their liabilities in giving unobtrusively many valuable pieces of advice to the Organizing Committee. This applies in particular to its chairman, Professor Borel." (A close collaboration had developed between the Consultative Committee and the Organizing Committee; Borel even took part in the formulation of the Congress Announcements.)

In speaking about the difficulties the Organizing Committee had had in trying to inform all mathematicians of the world about the Congress, I expressed gratitude to many institutions and individuals from whom help had been obtained: the American Mathematical Society, the newly founded African Mathematical Union, and Professor D'Ambrosio, in Latin America. "Much to our pleasure, there are members in this Congress from a higher number of countries than ever before."

Montgomery presented a report as Chairman of the Fields Medal Committee: "The Committee decided to follow the well-established tradition of considering only people of age 40 or under. Even with this limitation, the

list of those seriously considered numbered several dozen. After much deliberation and consultation and after considering advice from many outside the Committee, the Committee has selected four individuals for the award. They are, in alphabetical order, P. Deligne, C. Fefferman, G.A. Margulis, D. Quillen. I offer them our warm congratulations. Information has been received that unfortunately, G.A. Margulis is unable to be present, so his award will be presented to him later. I now ask Professor Rolf Nevanlinna, Honorary President of the Congress, to come forward to give the medals to the other three" [246].

After the opening session, lectures were given on the work of the Fields medalists. N.M. Katz said about Pierre Deligne, "Deligne's work centers around the remarkable relations, first envisioned by Weil, which exist between the cohomological structure of algebraic varieties over the complex numbers, and the diophantine structure of the algebraic varieties over finite fields" [247].

In speaking of the work of Charles Fefferman, Carleson pointed out that during the 1960s and 1970s, classical analysis was one of the most successful fields in all of mathematics. The reasons for this are the unification of methods from harmonic analysis, complex variables, and differential equations, and the discovery of the correct generalizations to several variables. In many problems complications cannot be avoided, and intricate combinatorial arguments rather than polished theories are at the center. This general description also summarizes the work of Charles Fefferman. In an eminent way he masters these techniques.

Tits reported on Gregorii Aleksandrovitch Margulis, whose work belonged to combinatorics, differential geometry, ergodic theory, the theory of dynamical systems, and the theory of discrete subgroups of real and p-adic Lie groups.

In presenting the work of Daniel Quillen, I.M. James said, "D.G. Quillen's contributions to algebra are outstanding in their inventiveness, conceptual richness, and technical virtuosity. He is the prime architect of the higher algebraic K-theory, and this is perhaps his finest achievement."

At the ICMs in the seventies, it was customary that participants arranged demonstrations for human rights, often concerning individual cases, but also for causes with political color. Helsinki was no exception. I heard of plans of an important event whose aim was to call attention to cases where human rights had been violated, in particular to the discrimination against Jewish mathematicians in the USSR. Such an event could easily be regarded as an anti-Soviet demonstration. The person in charge of the arrangements was Lipman Bers, whom I knew well. Together we agreed on where and how to arrange the event, with which the Congress could have nothing to do. All went well without trouble.

At the closing session, J.W.S. Cassels, Vice-President of the IMU, presented a report on the Otaniemi General Assembly. In addition to reporting on the events and resolutions described above, he called special attention

to the continued concern to the Union that some mathematicians are prevented from attending meetings sponsored by the Union.

> This can happen in two ways. The first is that mathematicians may be refused entry by the country in which the meeting is held; this has caused difficulties in the past to our Union but is not, we hope, now a great problem. The other way in which mathematicians may be prevented from attending is that their own country may refuse permission to attend. This is a continuing problem, as the present Congress has again demonstrated. These problems are not, of course, peculiar to our own Union but are common to the scientific community and have greatly occupied the attention and energies of ICSU. The General Assembly endorsed the stand of ICSU on this important matter and requested the incoming President to report on the situation to the next General Assembly.

K. Urbanik, speaking on behalf of the Polish National Committee for Mathematics, issued the invitation to the next International Congress, in Warsaw. "Poland, the home country of Banach, is eager to receive the worldwide mathematical community. For a long time, the Polish mathematicians have carried deep in their hearts the desire to organize an international congress, and we are very happy that we shall now have this opportunity."

In closing the Congress, I also mentioned the disappointing fact that so many of the invited speakers had failed to be present, almost all from the same country, and continued, "Our organizational task was greatly facilitated by the wealth of advice and material we received from the organizers of the Vancouver Congress. We in turn are more than willing to pass our experience, if it is requested, to our Polish colleagues. I wish best success to the ICM-82, and declare the 1978 International Congress of Mathematicians closed" [246].

The task of producing the Proceedings of the Congress still lay ahead. An extensive international invitation to submit offers for editing, printing, and distributing the Proceedings was arranged. The number of bids we received was large, and so was their price scale. A three-party arrangement was concluded. The publisher was the Finnish Academy of Science and Letters; with the promise that the book would cause no work and no costs to the Academy, the agreement was easy to achieve. In practice, this arrangement meant that the Finnish editor was in charge of the work, and the copyright remained with us. The American Mathematical Society prepared the papers for the printing office. In view of some Russian manuscripts, this was a part of the work for which we did not have the required competence in Finland. Finally, typesetting, printing, and binding the book was done by "Kultura," in Hungary. At that time, the setting of mathematical text was still largely

done manually. We knew that the Hungarian company could produce good mathematical text, and their price was extremely competitive.

The arrangement worked well, almost. The American Mathematical Society did its part of the work excellently, at a moderate cost. They also took over the distribution of the Proceedings, after the volumes ordered in advance had been dispatched from Hungary directly to the recipients. (Congress members always receive a copy automatically, free of charge.) The galleys from Hungary were satisfactory, but a sample copy of the book was unacceptable. A Finnish company prepared a model copy, with which I flew to Budapest, in order to find out whether a similar one could be produced by Kultura. The answer was yes, except that they could not guarantee that enough paper of good quality would be available. I promised to send the paper from Finland [248]. There were also complications with Kultura about the timetable, but all ended well, and so was well.

Thanks to the low production cost of the Proceedings; the donations from the private sector, which exceeded expectations; and the large amount of unpaid organizational work, the Congress showed a positive balance even after the support from the Ministry of Education had been paid back to the last penny. This meant that we were free to use the surplus. The IMU Special Development Fund received $5,000. From the rest a small Fund for Mathematics was formed under the auspices of the Finnish Academy of Science and Letters.

10

Politics Interferes with the IMU (1979–1986)

During the years 1979–1986, events of a political nature interfered with the activities of the IMU with unusual force and frequency. Before the Warsaw Congress could be held in 1983, two separate, serious crises had to be overcome, and then disagreement about the presidential candidate from the USSR forced the Union to spell out the precise meaning of its apolitical status. For getting China to join the Union, concessions had to be made to political pragmatism. In connection with these cases, the IMU confronted questions of morality. Such questions were also encountered in situations where the principle of free circulation of scientists was enforced. It was not always easy for the Union to find its way in the tangle of mathematics–politics–morality.

The difficulties of the IMU reflected political developments in the world. For East–West cooperation, conditions in the years following 1978 were not good. In December 1979 the Soviet Union invaded Afghanistan. Relations between the USA and the USSR became strained. Apolitical international activities also suffered. The decision of the United States to boycott the 1980 Olympic Games in Moscow, which some other countries joined, was not encouraging. In Poland, the Solidarity movement came into being in 1980. Its popularity increased rapidly among the Poles, whereas most other Socialist countries in Europe expressed their official disapproval of this development. Finally, martial law was introduced in Poland, eight months before the planned Warsaw ICM.

The Executive Committee of the IMU followed the deteriorating political situation and kept its antennae out. In April 1979 the IMU reiterated what it had resolved one year earlier: "When the EC agrees to sponsor scientific

activities of the Union, such as symposia, conferences, etc., the Secretary should remind the organizers that the IMU is a non-political organization and should emphasize that the name of IMU should not be used, directly or indirectly, in any petition or other political activity."

10.1 The IMU and the Soviet National Committee

After the Helsinki Congress, it was not clear how the Soviet Union would take part in the activities of the IMU, in particular, in the preparation of the mathematical program of the Warsaw Congress. From the beginning of 1979, Pontryagin, who had often been in disagreement with the other members of the Executive Committee, no longer was a member. However, the tacit agreement that there should be someone from the USSR on the Committee had been observed, and Yuri Prohorov, from Moscow, had been elected a member of the new Executive Committee. It was never learned what kind of policy Prohorov might represent in the Union. During his term, 1979–1982, he attended only one meeting of the Executive Committee, the last (extraordinary) meeting, in Paris in November 1982, where the fate of the Warsaw Congress was decided. Nor has a single letter from him been found in the files of the IMU. Thus the USSR remained almost entirely outside the work of the Executive Committee during the whole four-year period 1979–1982.

By a Resolution accepted by the IMU General Assembly in Otaniemi, the National Committees were invited to send to the Secretary of the Union, within the year 1979, detailed proposals, remarks, and comments on the selection of invited speakers to the ICM. Several countries took advantage of this opportunity. With the exception of the German Democratic Republic, all agreed that there was no reason to change the existing procedure. The Soviet proposal to let the National Committees select the speakers had found very little support from the members [249].

Following the customary schedule, the Executive Committee elected the Consultative Committee for the ICM-1982 at its first meeting after the Helsinki Congress, in April 1979. President Carleson made it known that he would appoint Jean-Pierre Serre (Fig. 10.1) as chairman of the Consultative Committee. Olech suggested that the Polish Organizing Committee should appoint four members; according to the rules, this number ranged from two to four. Arguments were given for a smaller number, and some thought that as a general rule, the number should be two. Finally, it was agreed to accept three members appointed by the Polish Organizing Committee. An extensive discussion was then required before the membership of the Consultative Committee was finalized.

Prohorov, who was not present, had suggested by phone that Yu.A. Rozanov, from the Soviet Union, be one of the members. The Executive

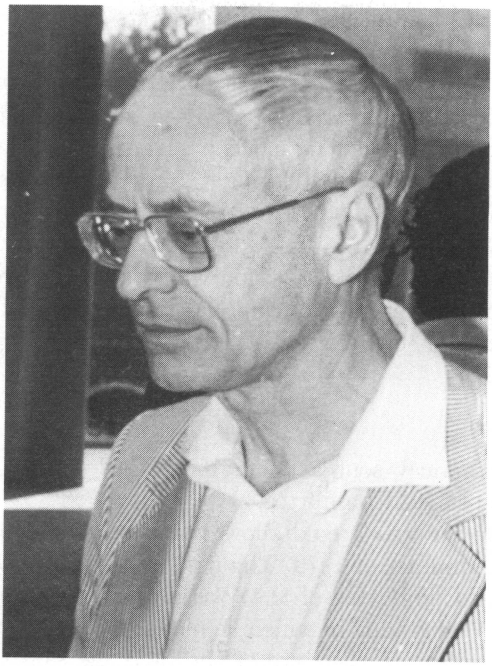

FIGURE 10.1. Jean-Pierre Serre (born 1926). French mathematician (algebra and topology). Vice-President of the IMU 1983–1986. Member of the Consultative Committee for the Nice Congress 1970, Chairman for the Warsaw Congress 1983. Member of the Fields Medal Committee for the Moscow Congress 1966. Fields medalist 1954.

Committee came to the conclusion, however, that better than Rozanov, Ludwig Faddeev, from Leningrad, would fit in the Committee. For a while, no answer was received from Faddeev as to whether he would agree to serve on the Committee [250].

In late May 1979, truly alarming news was received from the USSR. In a letter to President Carleson, Vinogradov, Chairman of the Soviet National Committee, wrote:

> On many occasions, Soviet mathematicians have expressed their dissatisfaction with the procedure used in selecting invited speakers for the ICMs. In spite of this, the Soviet National Committee proposed a first-class Soviet mathematician, Professor Yu.A. Rozanov, a specialist in the fields of probability theory, mathematical statistics, and differential equations, for the Consultative Committee. Unfortunately, Professor Rozanov was not appointed.
>
> In consequence, the Soviet National Committee has decided to recommend that Soviet mathematicians not take part in the

> work of the Consultative Committee or its panels. The Soviet National Committee will prepare a list of speakers to be invited from the USSR, with scientific motivations, and submit it directly to the Organizing Committee, requesting that those proposed should be included in the program of the Warsaw Congress. Therefore, the Soviet National Committee wishes that the Consultative Committee not invite Soviet speakers or members to the panels.
>
> Acceptance of this proposition will permit the avoidance of many misunderstandings during the preparations of the Warsaw Congress and create a scientific atmosphere during the Congress [251].

A month later, Faddeev sent a telegram to Carleson: "Cannot officially participate Consultative Committee."

Vinogradov's letter was a cold shower that triggered much correspondence during the summer of 1979. The first to react was Olech, Chairman of the Organizing Committee of the Warsaw Congress. In early June he wrote a letter to Vinogradov in which he made the Polish stand clear [252]. Referring to the rules of procedure of the IMU, he said that irrespective of the reasons behind the views of the Soviet Committee of Mathematicians and disregarding his personal opinion, the Organizing Committee of the Warsaw Congress could not invite and include in the program speakers not recommended by the international Consultative Committee, with the possible exception of a few Poles. Therefore, if the Soviet Committee were to send a list of mathematicians they wished to recommend as invited speakers, the only step the Organizing Committee could take would be to forward these proposals to the Consultative Committee. There would be no guarantee that the list as such would be accepted. The Soviet position would no doubt be weakened if Soviet mathematicians were absent from the Consultative Committee and the panels.

In stressing the gravity of the situation, Olech spared no words. He pointed out that a conflict was possible, the elimination of which was beyond the means of the Polish Organizing Committee. The only way by which the Poles could essentially contribute to a successful solution of the problem was to inform the Executive Committee of the IMU of the possibility that Poland would decline to organize the Congress unless the IMU would find, by the end of 1979, a compromise acceptable to the Soviet National Committee.

A couple of weeks later, Olech urged the Executive Committee to work towards a solution of the conflict: "I very much hope that taking into account the particular location of ICM-82, you will be able to work out a compromise which could be acceptable to both the Soviet National Committee and the EC, and which will allow us to believe that the ungrateful

and troublesome services we offered for the benefit of the world community of mathematicians are worth carrying on" [253].

Deeply worried about these developments, President Carleson and Secretary Lions were at first willing to make concessions to the Soviets. Carleson sent a draft memorandum of his proposition to the members of the Executive Committee and to Serre, the Chairman of the Consultative Committee [254]. The memorandum received a cool reception. The reactions of Olech and Serre were negative, nor did encouragement come from the other members of the Executive Committee. Cassels in particular analyzed the situation in several letters. "The situation is most worrying and perplexing." He found that Carleson's proposal, though ingenious, was unsatisfactory, on legal grounds alone. "In the light of the general discussion at the General Assembly at Helsinki, I suspect that the arrangements proposed in your memorandum would not be acceptable to the majority of members. I do not think that they could be regarded as special for the Warsaw Congress: they would clearly be regarded as a precedent for further Congresses." The only concession not meeting opposition among the Executive Committee was accepting Rozanov to the Consultative Committee; for this, Cassels too was prepared, "provided that there is a reasonable expectation that the Soviet National Committee will cooperate with the remaining arrangements; but otherwise, my feeling is that the Executive Committee should stand firm" [255].

When the summer was over, it was decided to "stand firm" and start the work of the Consultative Committee without a member from the USSR. At the same time it was agreed to postpone the appointment of panel members until the next meeting of the Executive Committee, to be held in the spring of 1980. This meant delaying the formation of the panels by almost a year; nobody had any notion then that for a different reason, the whole Congress would be postponed by one year.

Following an unofficial invitation, Olech went to Moscow in November 1979. The first discussions with Vinogradov (Fig. 10.2) and Pontryagin (Fig. 10.3) led nowhere. The protocol of the negotiations, signed by Vinogradov and Olech, contained six points [256]:

1. The categorical dissatisfaction of the Soviet Committee of Mathematicians with the procedure by which invited speakers were selected was noted. Further, Vinogradov and Pontryagin noted that the Consultative Committees have systematically discriminated against Soviet candidates, rejecting strong candidates proposed by the Soviet Committee and including in the program candidates well known to be weak. In this behavior of the Consultative Committees, an important role was played by the openly racist propaganda of the Zionists, widely advertised by the Western press.

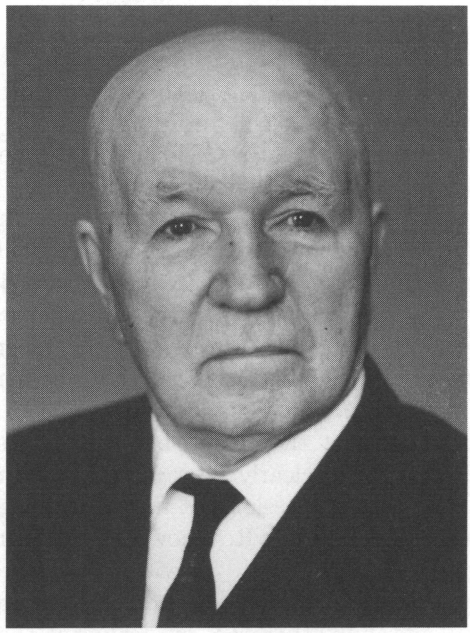

FIGURE 10.2. Ivan Matveevich Vinogradov (1891–1983). Russian mathematician (number theory). As Director of the Steklov Institute from 1934 until 1983, Vinogradov was a long-time leader of Soviet mathematicians. The first Chairman of the National Committee of Soviet Mathematicians 1956–1983, he brought the USSR to the IMU but challenged the Union's control over the program of the Warsaw Congress.

2. Western mathematicians with Zionist ideology have taken advantage of the ICMs for anti-Soviet political activity, which has nothing to do with and is detrimental to the scientific work of the Congress.

3. The Soviet Committee will prepare a list of Soviet mathematicians proposed to be invited as speakers and will submit it to the Polish Organizing Committee.

4. The Soviet Committee is of the opinion that the procedure in force before the Stockholm ICM-1962 should be restored; i.e., invited speakers should be elected by the national Organizing Committee on the recommendation of the participating countries.

5. In compliance with the wish of the Polish Organizing Committee, the Soviet Committee is doing its best for the successful execution of the Warsaw Congress. Should the justified claims of the Soviets regarding the selection of invited speakers from the USSR not be met with, the

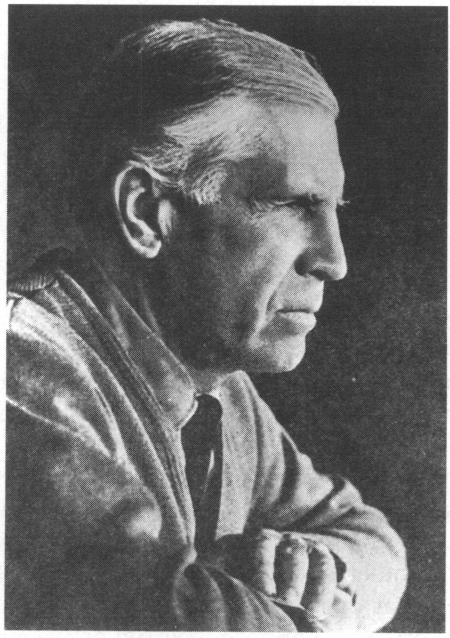

FIGURE 10.3. Lev Semenovich Pontryagin (1908–1988). Russian mathematician (topology, algebra, control theory). Vice-President of IMU 1971–1974, Member of the Executive Committee 1971–1978. Member of the Consultative Committee for the ICM-1966. Member of the Fields Medal Committee for the ICM-1974. He pursued the policy that National Committees instead of the Consultative Committee should select speakers for the ICMs, at any rate in the case of the USSR.

Soviet Committee will consider, as an extreme measure, withdrawing from the Congress.

6. Following the wish of the Polish Organizing Committee, the Soviet Committee intends to consider once more the possibility of the participation of Academician Faddeev in the activities of the Consultative Committee.

From this protocol the conclusion could be drawn that the internal harmony of the IMU had been thoroughly shaken. In addition to arguments used repeatedly since the early 1970s, anti-Semitism was now explicitly recorded. A total deadlock seemed inevitable. However, the following day, *mirabile dictu*, the atmosphere changed in Moscow. Olech met Academician E.P. Vielichov, a Vice-President of the Soviet Academy of Sciences. Vielichov assured him that a boycott of the Congress was out of the question and promised that Olech would obtain a letter from the President of

the Academy, A.P. Aleksandrov,[1] assuring cooperation and support for the ICM in Warsaw. (Such a letter did arrive, in early February 1980.) Thus Aleksandrov was aware of developments. He and Vielichov succeeded in turning the tide.

Olech later related that the same day he had met Vielichov, a friendly Pontryagin made contact with him, promising to convince Faddeev to accept the invitation to join the Consultative Committee. (By Faddeev's later account, what he needed was permission, not persuasion.) Pontryagin also promised to talk to Vinogradov and explain to him that a boycott of the Warsaw Congress was unrealistic and would be harmful to everybody.

Another paper was produced covering all negotiations between Olech and the representatives of Soviet scientific organizations [257]. It did not explicitly nullify the views presented in the first communiqué. However, its tone was so different that it gave reason to believe that the crisis would be overcome.

The developments indicate that the conflict with the Soviet National Committee was due largely to the Committee's President, Vinogradov, and Vice-President, Pontryagin. Their policy met resolute resistance from the Poles, nor was it endorsed by the leadership of the Soviet Academy. Olech later reported that during his visit he met several mathematicians in Moscow who supported him and who worked actively to find a way out of the crisis. The second paper mentioned that in addition to Vinogradov and Pontryagin, Olech was in discussions with Prohorov and with Gonchar, Zizcenko, Mishenko, and Faddeev. They sided with Olech, Zizcenko being particularly helpful in arranging contacts and providing useful information.

The situation had indeed changed. A couple of months later, in early February 1980, Carleson met Vinogradov and other members of the Soviet National Committee in Moscow. According to the laconic official protocol of the meetings, all wishes of the IMU were satisfied. The Soviet mathematicians would participate in the International Congress of Mathematicians in Warsaw, 1982, on a large scale; the Soviet National Committee would support full participation of Soviet mathematicians in the preparations of the Congress in Warsaw, 1982, and in the work of the Consultative Committee and its panels. The Soviet National Committee would support the participation of Academician L. Faddeev in the work of the Consultative Committee [258].

It was agreed "that the choice by the Consultative Committee of invited speakers should be based on information from panels and National Committees in a parallel way." This formulation was vague enough not to tie the hands of the Consultative Committee. It was also agreed that the proposals of the Soviet National Committee concerning the changes in the procedure of the selection of the invited lecturers to the Congresses would

[1] Aleksandrov and Vielichov were both physicists.

be discussed at the next General Assembly of the IMU. However, by the time the General Assembly was held, the discussion about the postponed Warsaw Congress dominated the meeting, and the question of how to select invited speakers was forgotten.

In early 1981 the Soviet National Committee submitted its list of the Soviet speakers it wished to be invited [259]. Of the thirty-eight names contained therein, nineteen were among those ultimately selected by the Consultative Committee, which added eleven more Soviet mathematicians from outside the National Committee's list. Of the thirty invited Soviet speakers, twenty-six were present at the Warsaw Congress. (The absentees were two of the nineteen and two of the eleven) [260]. These attendance figures were far better than had obtained in Vancouver and Helsinki. Thus these developments, which looked ominous for quite a while, ultimately had a happy ending.

In September 1981, Vinogradov's ninetieth birthday was celebrated in Moscow. On this occasion, an international mathematical conference was held. The Executive Committee members present, Carleson, Olech, and myself, were invited to a session with the National Committee of Soviet mathematicians. Vinogradov presided. Pontryagin was not present. Not a word was said about the program of the Warsaw Congress. The discussion was about the candidates for the next President and Secretary of the IMU [261].

10.2 Martial Law in the Host Country of the Congress

After the turmoil around the mathematical program of the Warsaw Congress had subsided, the preparations proceeded smoothly for a while. The Consultative Committee completed its work in the autumn of 1981. The First and Second Announcements were dispatched from Warsaw according to the timetable. The main document, the Second Announcement, which contained the registration form, was sent in early December 1981.

By that time, the political sky had darkened. With the strengthening Solidarity movement, greater freedom and respect for human rights were demanded in Poland. Internal restlessness was augmented by increasingly serious economic problems. Expanding liberalism was viewed with growing criticism by the countries of the Socialist bloc and with increasing nervousness by the Polish government. On 13 December 1981, martial law was declared in Poland. Tangible negative consequences of the "state of war" were the curtailment of citizens' liberties and the internment of Solidarity activists and other dissidents. Thus General Jaruzelski's move was far from popular in Poland, and it was viewed with dismay in Western countries.

A good number of mathematicians around the world felt obliged to express their moral protest against the declaration of martial law, which had a direct impact on the Warsaw Congress. A brief discussion of the situation leading to that declaration is therefore included here. At the time, mathematicians did not seem to have analyzed very carefully the underlying reasons for the Polish crisis.

The obvious reason for imposing martial law was the need of Jaruzelski and the other leaders of the country to consolidate their power. The government was threatened by the growing popularity of Solidarity, which had to be kept at bay. A second reason, so it was said, was the economic situation, which was rapidly deteriorating and was believed to approaching chaos. Martial law was needed to allow the government to take the drastic measures required.

However, a third reason overshadowed the two others. Today there is documentary evidence that martial law was a direct product of the Cold War [261]. In Moscow, developments in Poland were seen as a menace to the Soviet security system. Armed intervention, if the Polish authorities proved to be unable or unwilling to impose martial law, was an option widely discussed among the Soviet leaders in 1981. Brezhnev and other top Soviet officials were unwilling to lose their grip on Poland. The Soviet Politburo in 1980–1981 repeatedly affirmed that the Socialist commonwealth was indissoluble and its defense a matter not only for individual states but for the Socialist coalition as a whole.

On the other hand, many arguments spoke against military intervention in Poland. Soviet troops were already bogged down in Afghanistan. In comparison to Czechoslovakia in 1968, the Poles had a much larger population, and they had a long tradition of taking up arms against foreign invaders.

Even if Soviet forces could have overcome the Polish resistance, they would have been faced with the task of reviving the Polish economy while maintaining a costly military occupation. The Soviets preferred to work out an internal solution in Poland. In 1981, they exerted great pressure on the Polish authorities. In imposing martial law, Jaruzelski complied with the wishes of Moscow. In so doing he may well have saved Poland from Soviet military intervention [262].

With the introduction of martial law, Olech and his colleagues, as well as the international mathematical community, had new worries. The first reaction in the IMU was perplexity, strengthened by the concrete fact that connections with Poland had been badly disrupted. A rapid reaction came from the Belgian National Committee. Only five days after martial law had been imposed, the Belgian Committee volunteered to carry out a "salvaging operation ICM-1982." More precisely, "We in Antwerpen consider seriously the possibility of proposing to hold a slimmed-down version of the ICM-1982, Warsaw, if need be and if our colleagues over there will not be able to continue their work." In asserting their readiness for the job, the Belgians wished to be informed if (and when) the Polish colleagues had to abandon

their efforts, "a thing they did not want them to do" [263]. In his answer, President Carleson listed the many difficulties that would be involved with a transfer of the Congress. At this stage he was of the opinion that very likely, a total cancellation of the Congress would be the only realistic alternative. Not excluding entirely a Belgian ICM-1982, he asked whether they might be willing to organize the IMU General Assembly [264]. On 2 January 1982, the Belgians answered in the affirmative and informed the Union that the option of a Congress was also being kept open.

In the beginning of 1982, when the first shock was over, Olech felt that it was possible to make a reasonable assessment of the situation in Warsaw. In a letter to Carleson he wrote that he was worried but went on, "I am determined to fulfil my duties which I assumed some years ago in [the] best way I can" [265]. He, and along with him his staff, took a clear stand in favor of organizing the Congress in Warsaw.

Nevertheless, alarming news began to spread: the suspension of the Polish Mathematical Society and internment of Polish mathematicians, coupled with difficulties of a practical nature. Questions from all parts of the world about the fate of the Congress multiplied. It was decided that President Carleson, Secretary Lions, and I should visit Warsaw as soon as possible, to form an opinion on the spot. As a visit to a country in a state of war was seen as an adventurous undertaking, we were dubbed the "three musketeers."

The visit was scheduled to take place on 8–9 February 1982. Owing to the state of martial law, there was only one flight to Warsaw from Western Europe, which was from Copenhagen. The delay of the flight, which was announced piecemeal, amounted to ten hours. We thus had plenty of time at the airport to discuss the situation. Our views were not quite in accord. Carleson estimated the risks and difficulties of a Warsaw Congress to be so great that he was inclined to recommend cancellation forthwith. The IMU General Assembly could be held in Belgium, in an expanded version that would comprise a mini-congress as well. He had been in contact with the Belgians regarding this possibility, and they were engaged in full preparatory work [266]. I represented the opposing view that the Warsaw Congress should be saved if at all possible, thinking not only of the disappointment of the Polish organizers but of the damage the cancellation of the Congress by a majority vote might do for East–West cooperation, which had been so precarious in recent years. Both Carleson and I had arguments that were easy to justify, yet they were not commensurable. Of course, we all three knew that we lacked sufficient information to form a definite opinion.

If we languished at the airport the whole day, so did our Polish hosts—Olech and others—at the Warsaw end. They were anxious to rush us to the hotel, in order to be at home themselves before the eleven o'clock curfew. On the following day, weather contributed to the dreary outlook of Warsaw. The sky was uniformly gray; wet streets were sprinkled with spots of dirty snow. The military was patrolling here and there, but I did not see

pedestrians being stopped. Cars, including ours, were checked occasionally, but at least our situation was not frightening: A young soldier became convinced of our innocence after a brief explanation by our hosts. A few tanks flanked the road to the airport, but they were not visible in the center of the city.

Because of the compressed timetable, there was an uninterrupted series of meetings and discussions from 7:30 in the morning to 10:45 at night. We met the Secretary of the Polish Academy and all the members of the Organizing Committee. In addition, there was opportunity for private conversations with mathematicians outside the Organizing Committee, mostly colleagues whom we already knew. We found these informal contacts important in helping us to form an opinion of the feelings at the grass-roots level. Apart from some slight hesitation, the Polish stand was clear: the IMU General Assembly and the ICM should be held in Warsaw in August 1982 as previously agreed on. The motivation was both pragmatic and ideological. Since external conditions were improving, the Organizing Committee, supported by the Polish Government, did not envisage insurmountable difficulties. In August the Congress participants should not meet any serious problems. The ideology represented by most of our colleagues was that in this very situation, Polish mathematicians needed more than ever contact with their foreign colleagues. Carleson's appeal that the Belgian option would be in the best interests of the world's mathematicians was not supported.

In the report sent a few days after the visit to all members of the IMU Executive Committee, Lions condensed these discussions as follows: "We were extremely impressed by the apparently unanimous and very strong will on the part of the Mathematical Community of Poland to organize ICM in Warsaw" [267].

The Poles were reminded that in the new situation the IMU required that a number of conditions be fulfilled. The Polish government should give without delay renewed assurance that as before, the ICSU requirement of the free circulation of scientists would be observed. Precise assurances were demanded of the reestablishment of the suspended Polish Mathematical Society. The Government's answer should also contain firm promises that essentially normal conditions would prevail with regard to communications, transportation, and other aspects of life for the participants in the Congress. Of the state of martial law, Lions wrote in the report, "We have come to the opinion that it may not be necessary that the 'state of war' has ceased. The expression does not cover the reality that is usually associated with the term."

The outcome of the visit was to wait for the answer of the Polish Government, after which Olech should meet Carleson. A final decision about the IMU General Assembly and the Congress should be made at the latest at the meeting of the Executive Committee, to be held in Paris on 1–2 April 1982.

As early as 2 March 1982, the Polish Academy of Sciences was able to inform the Union that the plans for holding the ICM in Warsaw in summer 1982 had been reconfirmed by the Polish government. The Academy interpreted this to mean that the conditions imposed by the representatives of the IMU in Warsaw would be satisfied [268]. In his report about the discussions with Olech on 8–9 March 1982, Carleson expressed the view that there would very likely be no opposition to the present plans to hold the General Assembly in Warsaw, provided that 1. the suspension of the Polish Mathematical Society were removed before April 1 (the date of the IMU Executive Committee meeting) and that the release of interned mathematicians would continue; 2. the present trend of easing restrictions would continue until April 1 with the prospect that at the time of the General Assembly, transportation, telephone, and similar aspects of life would function essentially normally (including no curfew) [269].

About the ICM, Carleson pointed out again that the best interests of the mathematical community would have been served if the Polish organizers had in February 1982 offered their assistance in transferring the Congress to another site. However, as before, the determination to continue the plans was very strong in Poland. For this reason, and since time was running out, the possibilities of moving the Congress in 1982 were now very small. The risks of the Warsaw Congress were analyzed in detail, and for the first time, the possibility of delaying the Congress to 1983 was discussed. Neither Carleson nor Olech found this a tempting option. Yet this possibility was now brought forth from various directions from outside the IMU. The first seems to have been the Unione Matematica Italiana, which in late February made public its stand that if the ICM could not be held as planned, it would be more appropriate to delay the start of the Congress by a year rather than cancel it or shift it to another site [270]. A little later, the French and U.S. National Committees made similar recommendations.

By the time of the meeting of the Executive Committee on 1–2 April 1982, the Polish question had been under such scrutiny that reaching a decision was relatively easy. There was full consensus that the General Assembly should take place in Warsaw. The U.S. National Committee, which had expressed critical views about the ICM, had publicized its full endorsement for the General Assembly [271].

As for the Congress, it was decided that it should not be moved to another country. This decision was probably a disappointment for the Belgians, who had devoted work and funds to their salvage operation. But they graciously accepted the decision, assuring the IMU that they had never been competing with the Poles and expressing their willingness to be of service to the Union in the future [272].

On the other hand, the prevailing opinion was that there were too many risks and unknowns for a Congress to be held the following August in Poland. Considerably reduced participation, including that of invited speakers, would be likely, simply because the time between April and August was

Warsaw, April 1982

Dear Colleague,

This is to inform you that the Executive Committee of the International Mathematical Union at a meeting in Paris, April 1—2, 1982, considered the scientific prospects for a congress at the present time. They decided to postpone the ICM-82 to August, 1983.

The new dates set for the Congress are August 16—24, 1983, and the venue will still be Warsaw.

At the end of this year, a third announcement containing information about the Congress, the list of invited speakers, and new registration forms will be sent to you.

We apologize for the inconvenience this change may have caused you, and hope that you will be able to attend the Congress next year.

The Organizing Committee
of the ICM-82

FIGURE 10.4. Announcement of the ICM-82. The Polish organizers refused to take into account the possibility that the Congress might be canceled.

so short. Olech tried to defend his original position, but he was virtually alone. Prohorov was absent again, but the opinion of the Soviet National Committee was communicated by Nikolskii, who was in Paris as a Soviet observer. At an informal gathering before the meeting of the Executive Committee, he announced the Soviet view that the ICM could no longer be held the coming August.

After considering the scientific prospects for an ICM in 1982, the Executive Committee decided to postpone the Congress. Whether it could be held in the latter part of August 1983 would be discussed at the General Assembly in Warsaw in August 1982. On the basis of that discussion and in light of the scientific outlook for a Congress in August 1983, the Executive Committee would reconfirm or cancel the Congress at an extraordinary meeting in November 1982. Olech must have been prepared for this decision, because he was able to accept it on behalf of the Polish Organizing Committee. For the Poles, that the Congress would be held in Warsaw was still a matter of course (see Figure 10.4).

10.3 The 1982 General Assembly in Poland

The ninth General Assembly of the IMU was held in Warsaw during 8–9 August 1982. Since the days of the visit of the IMU triumvirate in early February 1982, the situation in Warsaw had greatly improved. Tourism

must have recommenced: In the streets near hotels, the military had been replaced by moneychangers. A person brought blindfolded to the Hotel Forum-Intercontinental, the venue of the General Assembly, would have had difficulty in guessing what country he was in, and least of all that he was in a country in a "state of war." The delegates to the General Assembly had good reason to praise their hosts' careful arrangements and friendly hospitality.

The meeting is well documented, having been wholly tape-recorded. Two typewritten transcripts of the tape were produced, one rather complete and the other an abbreviated one that was published in the IMU *Bulletin* [273].

The General Assembly was exceptional because of the long discussion about whether to hold the Congress in Warsaw in 1983. Politics, morality, and mathematics all had to be taken into consideration. This issue had the potential of providing the ingredients for serious drama, but such did not occur. The mood of the eighty-strong Assembly was amiable and conciliatory. Amid the confusing situation in Poland, which must have evoked mixed feelings, great sympathy was expressed towards the Polish colleagues. The prevailing sentiment could be summed up as, "Whoever may be guilty of having instituted martial law, our fellow mathematicians certainly are not."

In his opening address, President Carleson called attention to the special circumstances under which the meeting was taking place. The General Assembly could not meet at the same time as the International Congress, as prescribed in the Statutes as the normal arrangement, because the political development in Poland had forced the Executive Committee to postpone the Congress to August 1983. Members of the Assembly should now express their opinions as to whether the Congress could be held at that time and thus provide counsel for the Executive Committee, which would make the final decision in November 1982. Anticipating the unavoidable political character of these discussions, Carleson stressed the importance of keeping in mind that the Union is an apolitical organization. "Clearly, mathematics, as essentially all human activities, is related to political questions, but these questions should be handled through other channels."

The discussion about the Warsaw Congress was preceded by other business. The postponement of the Congress created a new situation regarding the Fields Medals. The Fields Medal Committee had reached its decision in the spring of 1982. The Executive Committee had considered it appropriate that the names of the winners should be announced at the General Assembly in 1982, while the awards should be given at the Congress that "we all hope could be held next year." Accordingly, Carleson announced that three 1982 Fields Medals had been awarded and that the winners were Alain Connes, C.N.R.S., France; William Thurston, Princeton University, USA; and S.T. Yau, Institute for Advanced Study, Princeton, USA.

The question for the 1986 International Congress was also settled by the General Assembly. The Site Committee had gratefully accepted the

invitation of the U.S. National Academy of Sciences to hold the Congress at the University of California, Berkeley.

Carleson continued by speaking about the relations of the IMU to the applied areas of mathematics. In his opinion, the IMU—in its present organization—overemphasized pure mathematics and its teaching.

> There is no direction of applied mathematics which has so much importance for the future as problems related to computers. We are here in the beginning of a development where problems of a mathematical nature will relate essentially all aspects of life. There are also an increasing number of papers and journals concerned with computer-related problems and an increasing almost unlimited market for young people. It seems of great importance that mathematicians take their part in this development. For this reason, the Executive Committee has with great satisfaction accepted an offer by the University of Helsinki to finance a prize in "Mathematical Aspects of Information Science," to be given every four years to a young mathematician working in this area. It is planned to be given at International Congresses. In honor of Rolf Nevanlinna, who died in 1980 and who served as our president 1959–1962 and who also took the initiative to the computer organization in Finland in the 1950s, the prize has been named the Nevanlinna Prize. The first award was planned for this year, and a Committee consisting of J.-L. Lions (Chairman), A. Salomaa, and J. Schwartz has made a decision of a winner.

The 1982 Nevanlinna Prize was awarded to Robert Tarjan, Stanford University, USA. (The developments that led to the Nevanlinna Prize will be described in Section 11.6.)

When questions related to membership were considered (for lists of members, see the Appendix, Section 1), an incident that occurred revealed a typical attitude of the IMU General Assembly. According to the Statutes, the member country Pakistan should have been dismissed from membership, because there had been no contact with Pakistan in more than eight years: There had been no replies to letters, and their dues remained unpaid. However, after a very long discussion, it was agreed that a member should not be excluded for purely financial reasons. The Executive Committee was asked to try once more to collect information about mathematical life in Pakistan.

After the customary surveys were presented about the activities of the IMU, a semantic decision was made: "The General Assembly approved the change of the name of the Committee for ICM from Consultative Committee to Program Committee." This was motivated by the misunderstandings caused by the name Consultative Committee, that "it is being consulted

and someone else is taking the decision." As mentioned before, this change in name could have been made as early as 1962.

The dominant item on the meeting's agenda, a discussion of the Warsaw Congress, was opened by Carleson with the general advice that the speakers should express their views as individuals. "Because of the difficulty of the situation, they should not try to unify anything at this moment into a unanimous statement. The aim is rather that the EC could collect as many opinions as possible for the decision-making in November." Olech then provided information about the preparations for the Congress. His detailed statistics on invited speakers proved that a good majority of them had accepted their invitations. This was relevant information for estimating the scientific prospects for the Congress.

A long discussion followed, in which a good number of the delegates took part. Although all opinions did not point in the same direction, the tone was friendly. The official IMU record speaks of a well-attended meeting in an admirable atmosphere of frankness [273].

When doubts were raised as to whether the members of the Organizing Committee could be regarded as enjoying the confidence of the Polish mathematical community, the delegates were reminded that the Organizing Committee had been elected before the declaration of martial law. The Assembly received the impression that if not all, then at least a substantial majority of Polish mathematicians were in favor of holding the Congress.

The speakers from Socialist countries now no longer saw insurmountable problems. Their views could be condensed as follows: "The Polish organizers have assured us that there are no practical problems that cannot be overcome. So let us have the Congress here next summer. We will certainly attend."

When opinions were expressed that the Congress could not be held unless martial law were abolished, Olech took a definite stand. He stated that there were serious reasons for such a drastic decision as the introduction of martial law; that otherwise, more tragic developments were likely to have occurred. Thus, he maintained, one should not expect martial law to be suspended before the circumstances that had caused it to be introduced no longer obtained.

Olech's message about the complexities of the Polish situation was not fully heeded: G.D. Mostow, head of the U.S. delegation, said, "When a country declares martial law, it announces that its authority is irregular, no longer resting on the consent of the governed." The moral aspect was explicitly announced: "The major obstacle before individual American mathematicians contemplating attending the Warsaw Congress is the moral repugnance at the imprisonment of many merely for exercising their rights as responsible citizens." And further: "How would we feel if, in 1986, there would be martial law in the USA, and my reply is: many American mathematicians, myself included and most of my colleagues, would say: keep away [from the Berkeley Congress]!"

Olech replied: "... Refusing now to organize the Congress would be perhaps a comfortable decision from the moral point of view but also irresponsible and harmful to all those who are eager to attend the Congress and especially to invited speakers who accepted the invitation and are anxious to address the Congress. We cannot turn our back to the responsibility we took in 1978 simply to avoid a morally uncomfortable situation." On the question of morality, the Polish delegate Schinzel commented, "As far as the moral aspect of the question is concerned, I should like to point out that for about two thousand years, it has been thought a good and charitable aim to visit people in prison. The conditions of the martial law, being harder than usual, can perhaps fall under that point" [274].

Some of those who were hesitant about the Congress or in opposition to it referred to the violations against human rights, calling special attention to the mathematicians still interned. Olech replied that their number was very small and decreasing. Another type of hesitancy arose from the fear that attendance at the Congress might be very low, and many of the invited speakers might refrain from coming. It was generally felt that an assessment of the scientific relevance of the Congress was the key problem. The more the discussion progressed, the more the opinion turned favorable to the Congress. Whatever doubts there were about the success of the Warsaw Congress, the other alternative, cancellation of the Congress, was seen to be detrimental to the Union.

Finally, J.F. Adams (U.K.) moved that "this Assembly will prefer that the Congress take place." A lively discussion followed about the details of the motion, whose wording was modified so as to leave more say to the Executive Committee in November. The mood of the Assembly was such that with all probability the motion would have carried. For the Poles it would have been a victory. In this situation Olech, who would have been the greatest personal winner, showed statesmanship. He said that the resolution introduced by Professor Adams should not be voted on. The resolution would not be accepted unanimously, and this would put the Executive Committee in the situation that any decision it took would be against some members of the Union and might be dangerous for the future of the Union. A decision taken by the Executive Committee in November would not carry such a danger, since the Executive Committee members do not represent any country but only themselves as individuals. Thus it would be better to leave the question without any instruction from the General Assembly and let each member of the Executive Committee individually draw conclusions from the discussion of the General Assembly, which had supplied much information about the opinions of different member countries on the issue. Following Olech's words, Adams withdrew his motion.

In conclusion, Carleson briefly summarized that the spirit of the discussion was first of all that the work of Polish mathematicians was recognized and appreciated and that all wished to arrange a successful Congress in 1983. The difficulty lay in the interpretation of words like successful.

The Union's finances were discussed and elections held on the second day of the Assembly. The unit contribution was raised from 600 to 850 Swiss francs. There were good reasons to raise the dues, which had remained constant since the 1974 General Assembly: considerable inflation everywhere in the world during the eight years 1975–1982, fluctuation in exchange rates (the rise of the dollar), decreasing ICSU/UNESCO subvention by the decision of the ICSU General Assembly in 1980, and increasing activities of the Union. These facts persuaded the Assembly to accept the relatively large increase.

The General Assembly elected the following Executive Committee of the IMU for the four-year period starting 1 January 1983:

President: J. Moser (Switzerland) (Fig. 10.5)

Vice-Presidents: L.D. Faddeev (USSR), J-P. Serre (France)

Secretary: O. Lehto (Finland)

Members: S. Mizohata (Japan), G.D. Mostow (USA), M.S. Narasimhan (India), C. Olech (Poland), J. Palis Jr. (Brazil)

The retiring President L. Carleson would be an ex officio member without vote.

The new Committee exhibited a geographical expansion. Since 1952, the number of members from outside Europe had always been two. Now it was four.

With the election of the new Secretary (Fig. 10.6), the domicile of the Union from 1 January 1983 would move to Finland. The address would be Department of Mathematics, University of Helsinki. A good tradition could be continued in that the secretarial costs of the Union during the years 1983–1990 were covered by funds from Finland.

For ICMI, J.P. Kahane was elected President and A.G. Howson Secretary. H. Hogbe-Nlend was reelected Chairman of the Commission on Development and Exchange [273].

10.4 ICM-1983 in Warsaw: Mathematics Above Politics

Political developments in Poland in the autumn of 1982 were not promising. In October, the Parliament passed a new law concerning labor unions that made Solidarity illegal. In protest, workers in the Gdańsk dockyard went on strike. Lech Wałęsa remained in custody. Restlessness and demonstrations continued everywhere, and dissatisfaction against the restrictions on civil liberties increased.

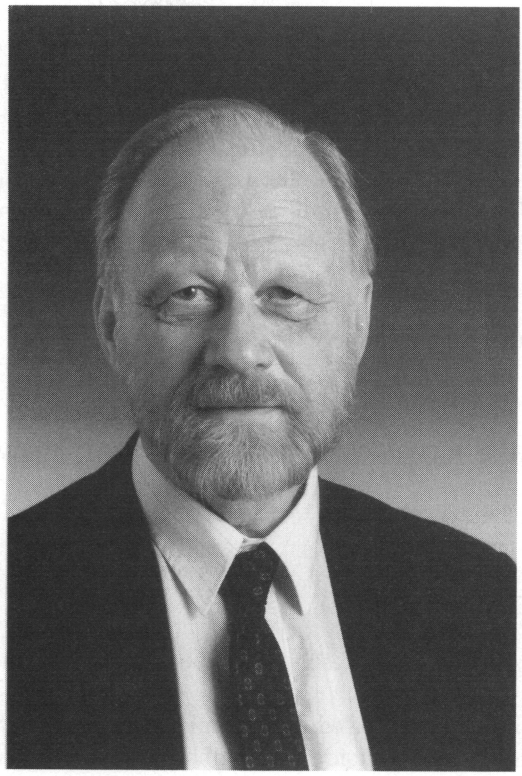

FIGURE 10.5. Jürgen Moser (born 1928). German-born American mathematician (differential equations and celestial mechanics). Professor at the Federal Institute of Technology, Zurich. President of the IMU 1983–1986. Member of the Fields Medal Committee for the Helsinki Congress 1978 and Chairman ex officio of the Fields Medal Committee for the Berkeley Congress 1986.

The feeling started to spread that Poland was, after all, not an appropriate site for the ICM in 1983. In October 1982, the French Mathematical Society accepted a resolution against the Warsaw Congress [275]: *"Elle considère que dans l'état actuel des choses, et compte tenu en outre des évènements récents, la tenue du congrès est inopportune."* (In the present state of affairs, and considering furthermore recent events, holding the Congress is inopportune.) In the spring of 1982, the stand of the Society had been more positive,

At the same time, the Chairman of the U.S. National Committee for Mathematics, G.D. Mostow, expressed his categorical stand:

> A month ago I requested the members of the U.S. National Committee on Mathematics to sample opinion in their regions of the country about attending an International Congress of

FIGURE 10.6. Olli Lehto (born 1925). Finnish mathematician (complex analysis). Member of the Executive Committee of the IMU 1975–1990, Secretary 1983–1990. Member of the Consultative Committee, Chairman of the Organizing Committee, and President of the Helsinki Congress 1978.

> Mathematicians in Warsaw, August 1983. The responses that I received from my committee members were remarkably uniform. Everywhere mathematicians strongly reject the idea of attending such a Congress. Over 80% of the responding mathematicians replied that they would not go even if granted travel funds. The reasons offered for not going are: 1. Reluctance to run the risk of getting engulfed in demonstrations. 2. Attending the Congress sanctions the present Polish regime. 3. Attendance would be tantamount to rejection of their personal beliefs about civil liberties.

And further: "The only mathematicians expressing strong desire to attend the Warsaw Congress were those who were planning to make public protests on behalf of imprisoned mathematicians [276].

It should be added that both the French Society and Mostow expressed strong sympathy for Polish mathematicians.

I spent the fall term 1982 in the USA and did some private investigation about the Warsaw Congress. In conformity with Mostow's report, I found that interest in attending the ICM was not high. The reason usually given was the difficulty in getting a travel subvention: Since January 1982 there had been a block on the use of federal funds for travel to Warsaw, despite recommendations by the National Academy of Sciences and by scientists in government service to lift the block.

Before the meeting of the Executive Committee in Paris, Vice-President Nagata wrote that he would not come all the way from Japan to Paris given that the probability that the Congress would be canceled was so high. Olech, of course, represented the opposite view; and Prohorov, who was supposed to come to Paris but was not there the day the meeting was to begin, was a big question mark. I was still inclined to try to prevent cancellation of the Congress if possible.

On my arrival in Paris, I had discussions with Carleson and Lions. Carleson had come by way of Warsaw and brought with him the assurance of Vice Prime Minister Rakowski that martial law would be canceled by the end of the year. Lions told that the fresh news of the Pope's visit to Poland in summer 1983 had influenced opinions in France and Italy. In the same direction was Wałęsa's forthcoming release. (He was released from custody on November 15.) But I went to bed unable to predict the outcome of the meeting the following morning [277].

When the discussion about the Warsaw ICM began on 13 November 1982, at the Collège de France, present were Carleson (Chairman), Lions (Secretary), Bombieri, Cassels, Kneser, Lehto, and Olech. Not much progress had been made, when the door opened and in came Prohorov, for the first time in attendance at an Executive Committee meeting. He soon asked for the floor and quietly elaborated his view on why holding the Congress would be in the better interests of the IMU than canceling it. He concluded by saying that as regards international contacts, mathematicians in Socialist countries were handicapped. They could not participate in the ICM-1986 at Berkeley in great numbers. Warsaw, in contrast, would provide them an excellent opportunity to meet colleagues from all over the world.

The matter-of-fact performance of Prohorov was to the taste of the Executive Committee. He certainly contributed to the final decision. After a long discussion, the Executive Committee decided to confirm the organization of the ICM-82 in Warsaw in August 1983.

The decision defied widespread general opinion. How to make it public was therefore of importance, and the Executive Committee devoted due effort to the formulation of the announcement. It began with a reference to the General Assembly in Warsaw, to contacts with National Committees

and the Polish organizers, and to Carleson's meeting with the Vice Prime Minister. The reasons in favor of holding the Congress were then explained:

> Information and views received did not point in a single direction, and the Committee had considerable difficulty in reaching its decision. In the light of all the information, the Executive Committee did not feel justified in taking the drastic step of canceling the Congress. On the other hand, the Executive Committee believes that there are indications that a Congress in 1983 could be scientifically successful. The tradition of regular congresses is an important one which has only been interrupted during the two world wars. It is our conviction that our decision to hold the International Congress of Mathematicians in 1983 best promotes international cooperation in mathematics. In reaching this decision, the Executive Committee expresses its sincere wish that all those connected with the Congress will respect its non-political nature.

Two days later, Secretary Lions sent the text to the National Adhering Organizations and the National Committees of the Union, and it was printed in the IMU *Bulletin* that appeared in December 1982 [273].

The decision taken in Paris prompted the Polish organizers to prepare a Third Announcement. It contained all the information given in the Second Announcement, but brought up to date, and also a list of the invited speakers with the titles of their lectures as well as a rough schedule. The mailing of this announcement began towards the end of January 1983.

The Congress was held during 16–24 August 1983. The mathematical activities and the opening and closing ceremonies took place in the skyscraper building "Palace of Culture," in the center of Warsaw. The setting resembled greatly that of the Moscow Congress; even the architecture of the Palace of Culture was similar to that of the main building of Moscow University.

In view of the prehistory of the Congress, special attention was paid to attendance in general and the presence of invited speakers in particular. Total attendance, 2,200 mathematicians from sixty-five countries, was about one-fourth less than what it had been at the Helsinki ICM. More than one-third were Poles (830). Socialist countries were well represented, the USSR with 280 participants, more than fivefold the Helsinki figure. In contrast, attendance from the USA dropped from over 600 at Helsinki to 110. In comparison with the Helsinki Congress, the relative reduction of the American participation was greater than that of France, the Federal Republic of Germany, Japan, or the U.K.

Of the 145 invited speakers, 110 were present. The ratio was worse than that in Helsinki, where these figures had been 136 and 120, but it was still satisfactory. In Helsinki, almost all absent invited speakers had been from the Soviet Union, now they were mostly from Western countries. Of the

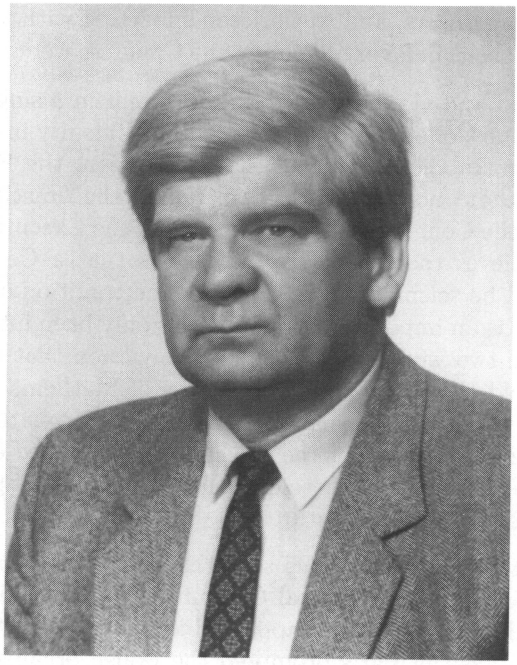

FIGURE 10.7. Czesław Olech (born 1931). Polish mathematician (dynamical systems). Member of the Executive Committee of the IMU 1983–1990. Member of the Consultative Committee for the Helsinki Congress 1978. As Chairman of the Organizing Committee and President of the Warsaw Congress 1983, he had to master exceptional difficulties.

sixteen plenary speakers, thirteen were present, including all from the USA and the USSR.

At the opening ceremonies, the Union's President Carleson first presented the history of the ICMs in a nutshell:

> Already at the Zurich meeting in 1897 it was stated that the first objectives of the Congress are to promote the personal relations between mathematicians from different countries and to give a survey of the state of our science. The rules of the congresses have, through the years, become firmer, and since 1962 the IMU is formally responsible for the scientific content. This Congress meets under special circumstances, but the main objectives remain, and to keep unbroken traditions has been a fundamental concern to the IMU.

Czesław Olech (Fig. 10.7) was then elected President of the Congress. In his address he called special attention to Kazimierz Kuratowski, once very active in the IMU and who strongly advocated the initiative to invite

the Congress to Poland: "I am very sorry that he did not live long enough to share with us this happy moment."[2] At Olech's suggestion, Władysław Orlicz, "the Nestor of Polish mathematicians, who for more than fifty years has been enriching the mathematical tradition in Poland," was elected Honorary President of the Congress.

Olech concluded his address by remarking that Warsaw is a well-known center of mathematical research. "It was here that the first specialized international journal of mathematics was founded. I am speaking of the *Fundamenta Mathematicae*. Here, for the last ten years, mathematicians from all over the world meet regularly at the Stefan Banach International Mathematical Center, a common enterprise of the Academies of Socialist countries. Let me express the hope that this Congress will contribute to all these international mathematical traditions to a considerable extent."

Olech ceded the floor to the Patron of the Congress, Aleksander Gieysztor, President of the Polish Academy of Sciences, a historian. He reminded the audience of the disastrous effects of the Second World War on the Polish scientific community. More than half of the actively working Polish mathematicians lost their lives. Many others found themselves after the war in various countries all over the world. The educational system was in ruins and scientific activity disrupted. The fact that this Congress was being held in Warsaw in 1983, thirty-eight years after the war, gave evidence of the reconstruction of Polish science. In particular, it was proof of the renaissance and expansion of the Polish mathematical community, which was now many times larger than it had been before the Second World War.

The announcement of the Fields Medals winners is a highlight of the opening session of ICMs. Because the Congress was one year late, there was no secrecy this time about the names of the medalists and the winner of the Nevanlinna Prize, as they had been publicized already in August 1982, at the IMU General Assembly. But the awards ceremony took place in front of the Congress participants. Connes, Tarjan, Thurston, and Yau received their prizes from Honorary President Orlicz.

After that, reports of the medalists' work were presented. Huzihiro Araki opened his address on the work of Alain Connes as follows: "The theory of operator algebras, after being quietly nourished somewhat in isolation for thirty years or so, started a revolutionary development around late 1960s. Alain Connes came into this field just when the smoke of the first stage of the revolution was settling down. He immediately led the field to breathtaking achievements beyond the expectation of experts."

The report on W. Thurston's work by C.T.C. Wall was read in Wall's absence. "Thurston has fantastic geometric insight and vision; his ideas have completely revolutionized the study of topology in two and three di-

[2]Kuratowski had died in June 1980.

mensions and brought about a new and fruitful interplay between analysis, topology, and geometry."

Like Wall, L. Nirenberg, who should have presented the work of Shing-Tung Yau, had not come to Warsaw himself but had sent the manuscript of his report. "Yau has done extremely deep work in global differential geometry and elliptic partial differential equations, including applications in three-dimensional topology and in general relativity theory. He is an analyst's geometer (or geometer's analyst) with remarkable technical power and insight. He has succeeded in solving problems on which progress had been stopped for years."

Finally, Jacob Schwartz spoke about the work of Robert Endre Tarjan, the first winner of the Nevanlinna Prize. Schwartz felt that for describing Tarjan's achievements, some remarks on the nature of the field were required. "Pure mathematics enjoys the luxury of studying its constructions, whether finite or infinite, in complete independence of all questions of efficiency. By contrast, theoretical computer science must ultimately concern itself with computing engines which operate with limited speed and data storage, and therefore must take efficiency as one of its central concerns. Two closely related activities, algorithm design and algorithm analysis, grow out of this inevitable concern with efficiency.... Robert Tarjan has been a leader of both these enterprises, which lie at the intellectual heart of computer science...."

At the closing session of the Congress, it is customary for the President of the IMU to present a report on the activities of the previous General Assembly. Since the Congress had been postponed by one year, the resolutions of the General Assembly had been printed in the IMU *Bulletin* and distributed long before the Warsaw ICM. Thus the address on behalf of the IMU did not need to go into such details. Instead, some words from the Union on the exceptional circumstances that had led to the Warsaw Congress in 1983 were expected. There were two possible speakers: Carleson, the past President of the Union, under whose chairmanship the General Assembly had been held and the decision about the Warsaw Congress taken, or Moser, the President of the Union at the time of the Congress. The Gordian knot was untied by their agreement that the Secretary speak in the name of the Union.

I said, "It is of course not up to me to make a general evaluation in public of whether our decision [to hold the ICM in Warsaw in 1983] was correct or not. But let me say that I am very happy that the ICM-82 now took place here. The continuity of international cooperation was maintained, and in spite of regrettable absences of some invited speakers, this was a high class meeting from the scientific point of view."

Having thanked the Polish colleagues and given a special tribute to Olech, the Chairman of the Organizing Committee and President of the Congress, I finished as follows: "Let me conclude by emphasizing the basic principle of IMU that politics should never find a foothold within the Union. As

individuals, we may of course have whatever political views we choose, but when it amounts to organized international cooperation in mathematics, then political aspects should be put aside entirely. Our fine science should be the uniting link between us and make us in a true sense one big mathematical family." This part found an unexpectedly audible echo. After the words "that politics should never find a foothold within the Union," the audience burst into a huge ovation.

The decision of the General Assembly concerning the site of ICM-86 was ceremonially confirmed when Jack Hale extended an invitation to attend the Congress, to be held in 1986 in Berkeley, California, USA.

The session closed with the address by Olech. He paid special attention to the continuity and accumulated experience in organizing ICMs, thanking the organizers of the previous Congress in Helsinki for their help and adding, "If we can pay this back by being of any use to the organizers of the next Congress, in Berkeley, we shall be only too happy." Finally, in view of all the difficulties preceding the Congress, it must have been a highly rewarding moment for Olech to be able to say the last words: "We came to what I personally consider a happy end and I declare the ICM-82 in Warsaw closed" [260].

The Warsaw Congress was soon subjected to a detailed assessment. This was done by G.D. Mostow in an article that appeared in October 1983 [278]. Mostow had been the most outspoken critic against holding the ICM in Warsaw. Now his conclusions about the Congress were positive on all essential points.

First, Mostow found that the arrangements, both physical and scientific, had been very efficiently organized. The caliber of the invited speakers was excellent, the level of exposition was generally high, and the coverage of all mathematical areas was comprehensive. Apart from the scheduled lectures, the informal interchanges between mathematicians who normally cannot meet were substantial. A number of the very best Soviet mathematicians, who previously had not been permitted to attend congresses, had been able to come to Warsaw.

Summarizing the mathematical yield, Mostow wrote, "There was wide consensus that, scientifically, the Congress was a success." Having noticed that Polish mathematicians seemed to be deeply gratified that the Congress had taken place, Mostow arrived at his final conclusion: "In retrospect, the decision made by the IMU Executive Committee in November 1982 to hold the Congress turned out to be a fortunate one."

The opinion that the Warsaw Congress was successful has been generally endorsed and has stood up over time. After all the problems, risks, and doubts, the Warsaw ICM had served the best interests of international cooperation in mathematics.

10.5 The 1986 Presidential Election

The President of the IMU is elected by the General Assembly for a term of four years. Reelection is not possible, but the retiring President remains a member without vote of the Executive Committee for the following four years. The rules concerning the election of the President are contained in the "Procedure for the Election of the Executive Committee," described in Section 5.3.

So far, the presidential candidate proposed by the Executive Committee has always been elected. There are no clear-cut rules of how the Committee's candidate should be selected. It has happened that an "obvious" name is brought forth and unanimity within the Executive Committee is readily reached. Or else the discussion starts with a number of possible candidates. Names suggested by the National Committees often concur with those under discussion within the Executive Committee, but until 1985 they had not had a decisive influence.

An essential condition is that the President be a scholar held in high esteem on the basis of achievements in mathematical research. Administrative capability is subordinate to mathematical merits. Geographical distribution is also a side condition to be taken into consideration. Before presenting its slate, the Executive Committee must secure the agreement of the candidate to serve if elected. It has happened a few times that a prospective presidential candidate has declined.

In the first informal discussions about the selection of the President for the four-year period 1987–1990, the name of Vice-President J-P. Serre had been mentioned. At an early stage he made it known, however, that he did not wish to serve as President of the IMU. Before the 1985 Executive Committee meeting convened, the Soviet National Committee suggested, in March 1985, that Ludwig Faddeev be elected President [279]. Considerable time at the meeting of the Executive Committee on 9 May 1985 was devoted to a discussion of Faddeev's candidacy—one year before the Executive Committee's decision had to be finalized. The minutes of the Executive Committee meeting say not a word about the details of this discussion, but the pros and cons were presented in the letter the Executive Committee member Mostow sent to the members of the U.S. National Committee for Mathematics four days later [280].

An argument in favor of Faddeev was the fact that of the mathematical superpowers, the USA had had three IMU Presidents (Stone, Montgomery, and Moser),[3] the USSR none. Remarks concerning this imbalance had been made a few times by the Soviets. It was agreed at the meeting that Faddeev was a mathematician of high standing who had excellent personal qualities.

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[3]At the time of his election, Moser was professor in Zurich, but he was a citizen of the USA.

To quote Mostow: "He understood the West, and concerns regarding East–West cooperation could be directed to him openly." Not agreeing to the proposal of the USSR might prove detrimental to Soviet collaboration in the IMU, particularly since a negative decision could not be easily justified.

Arguments against Faddeev were functional and symbolic. Fears—said to derive from past experience—were expressed that in Leningrad, Faddeev could be badly incommunicado. Worse still, even as President, he might be subjected to constraints imposed on him by the official Soviet bureaucracy.

At the symbolic level, Mostow took up the matter of discrimination against Jewish mathematicians in the Soviet Union. His decision was to oppose a Soviet as President at this time, on the grounds that there were continuing and substantial violations of the norms of scientific merit in the Soviet mathematics faculties.

The outcome of this preliminary discussion was that Faddeev enjoyed considerable support among the members of the Executive Committee. Mostow was against, and he was not alone. But the majority in favor of Faddeev was so large that it looked as if the question of the presidency had been more or less settled.

However, Mostow (Fig. 10.8) was determined to prevent Faddeev from becoming President. As related above, immediately after the Executive Committee meeting, he sent a letter to all members of the U.S. National Committee for Mathematics, and added Deane Montgomery and Louis Nirenberg to the list of recipients. In addition to an impartial description about the course of discussions at the Executive Committee meeting, the letter contained an analysis of why Mostow was unable to accept Faddeev as President of the IMU. Finally, Mostow asked the recipients to return the enclosed ballot, marking their preference for the next President of the IMU among the hypothetical slate of candidates Atiyah, Hirzebruch, and Faddeev.

In this ballot, Faddeev lost to Atiyah and Hirzebruch. Mostow informed President Moser, Past President Carleson, and the Secretary of the IMU of the result [281]. His letter was not marked confidential. In fact, by making "case Faddeev" more widely known, it appears that Mostow hoped to be of assistance to Jewish mathematicians in the USSR. In his letter Mostow put some specific blame on Faddeev's actions in the Soviet Union. On the other hand, he mentioned as a counterexample Faddeev's "vigorous efforts to gain full membership in the USSR Academy for Gel'fand and corresponding membership for Arnol'd." In all, it can fairly be said that Mostow's opposition was primarily to the election of a Soviet President and not to Faddeev himself.

Mostow's letter indicated that a serious crisis was brewing in the IMU. The Executive Committee was between Scylla and Charybdis. Of the three of us—Moser, Carleson (Fig. 10.9), and me—each formed an opinion about Mostow's letter independently of the others. It turned out that in spite of the complexity of the question, we all arrived at the same conclusion. The

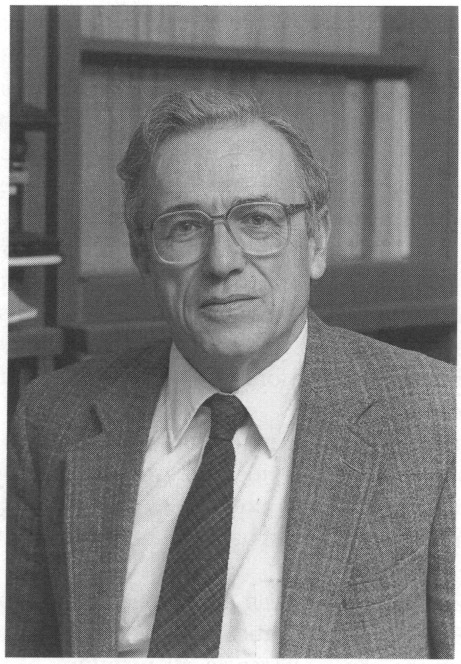

FIGURE 10.8. George Daniel Mostow (born 1923). American mathematician (differential geometry) and human-rights activist. Member of the Executive Committee of the IMU 1983–1986. Chairman of the U.S. National Committee for Mathematics. Mostow later was President of the American Mathematical Society.

crux of the matter was, so we felt, that officers of the IMU are elected as individual mathematicians, and member countries cannot be discriminated against. Therefore, Mostow had to be persuaded to withdraw his opposition to Faddeev.

Mostow's reasoning was based on the need to appreciate moral values, and his arguments were not unfounded. But we felt that taking a stand in favor of Faddeev's presidency did not mean an approval of the treatment of Jewish mathematicians in the Soviet Union.[4] Mostow's action was directed against the political system of the USSR, and political problems should be dealt with by other organizations.

The possible influence of the IMU on the position of ill-treated mathematicians in the USSR was soon to be overshadowed by political events.

[4]Famous was the case of V.I. Arnol'd, who had been invited by Oxford University to give the Union lectures but had not been permitted to leave the USSR. This led to extensive correspondence between the IMU and Moscow, which began in the mid-seventies and lasted for more than ten years.

FIGURE 10.9. Past President Carleson, Vice-President Faddeev, and President Moser at a meeting in Leningrad in 1984 on the occasion of the fiftieth anniversary of the Steklov Institute. A few months later, the presidential candidacy of Faddeev forced Carleson and Moser to analyze the apolitical status of the IMU.

After Gorbachev's rise to power in 1985, *perestroika* and *glasnost* signaled the dawning of a new era. But in the mid-1980s, these developments were still unforeseeable.

Mostow remained unbending, and additional weight to his stand was rendered by his personal qualities and his status as a mathematician: He had a worldwide reputation as an outstanding mathematician; he was the Chairman of the U.S. National Committee for Mathematics; and he was to become President of the American Mathematical Society. His motives were ideological, involving no personal or national interests.

A "fight" between Mostow and the three IMU recipients of his letter was inevitable. The exchange of views was mostly carried on orally; an exception was a letter Carleson wrote to Mostow in July 1985 [282]. The debate was analytical—among divergent opinions, personal relations remained correct. Moser, the President of the IMU, had lived more than a quarter of a century in the United States, twenty years as a professor at the Courant Institute, in New York, and his concern for Jewish mathematicians in the USSR was well known. Thus he was in an especially good position to influence opinion among American mathematicians. Eventually, the U.S. National Committee, headed after Mostow by Mary Ellen Rudin, announced its support for Faddeev, and Mostow retreated.

Yet Mostow insisted that his views opposing discrimination against scientists should be observed by the Union. After much time and effort had been spent to find the appropriate formulation, the following Resolution was accepted by the General Assembly at its 1986 meeting: "One of the principal objectives of the IMU is to promote international cooperation for the advancement of mathematics. It is therefore of fundamental importance that adhering organizations support the basic policy of non-discrimination including freedom of access to higher education, publication in international journals, and participation in mathematical meetings, as expressed in the ICSU Statute, Article 5" [283].

The final act in the election of the President, which took place at the meeting of the General Assembly in Oakland on 1 August 1986, was anticlimactic. With only one candidate, the pragmatic chairman Moser suggested that the new President be elected by acclamation. The Assembly agreed, and so, for the first time, written ballots were dispensed with. Afterwards, President-Elect Faddeev expressed his dissatisfaction with the procedure: "An election like in my country."

10.6 China Joins the IMU

In Section 6.2 an account was given of the first attempts to persuade the People's Republic of China to become a member of the IMU, and of the political problems caused by the existence of the Republic of China in Taiwan. The admission of the Republic of China, under the name China–Taiwan, to the IMU cooled relations with the People's Republic of China, and no contact could be established with Beijing. In the mid-sixties the Cultural Revolution seemed to quench all interest on the part of Mainland China for international scientific contacts. Yet political developments a few years later gave rise to new activity.

In 1971 the United Nations admitted the People's Republic of China as a member and dismissed the Republic of China. This decision had repercussions that through UNESCO and ICSU reached the IMU. In January 1975, the Executive Secretary of ICSU informed all Unions of a letter received from UNESCO's Director-General Amadour-Mahtar M'Bow. In it attention was called to the resolution of November 1974 of the General Conference of UNESCO, which reiterated that the government of the People's Republic of China was the only legitimate representative of China in UNESCO. It urged all international nongovernmental organizations maintaining relations with UNESCO in which bodies or elements linked with Chiang Kai-shek still participated having illegally usurped the name of China to take measures to exclude them immediately and to break off all relations with them. The resolution asked that a report be submitted on

this subject to UNESCO, and so did the Director-General, even more explicitly, in his letter [284].

UNESCO differs from ICSU and the Unions in being a political, governmental organization. ICSU has emphasized since its founding in 1931 that it is apolitical—open to scientists from throughout the world. In order to avoid political problems, it had declared that the term "country" in its statutes included territories having independent scientific activity. In 1958 the ICSU General Assembly further clarified this by resolving that "country" was to be understood in an apolitical sense and did not involve the recognition of its government or of any political status. To break off all scientific relations with China–Taiwan would have been in violation of ICSU's fundamental policy. Yet the pressure from UNESCO was felt in ICSU, which receives an annual subvention from UNESCO. The Unions are closely associated with ICSU, and they receive support from UNESCO through ICSU. That is why the Unions, in spite of their autonomy, were also affected by UNESCO's intervention.

Not long after ICSU and the Unions had been apprised of UNESCO's resolution, the political climate changed in the People's Republic of China. Mao Zedong died in 1976, and soon after that China became active in establishing international academic contacts.

The various Unions reacted variously to UNESCO's resolution and the Director-General's reminder. In August 1976, the International Union of Geological Sciences (IUGS) expelled China–Taiwan from its membership and admitted the People's Republic of China as a member. "An error was made in accepting the Geological Society of China, located in Taipei, as representing China." A year later the International Union of Geodesy and Geophysics (IUGG) made a similar move. The procedure was recommended to the IMU as well. However, as will appear from the following account, the IMU assumed a different moral stand: Even though the membership of the People's Republic of China would promote international cooperation in mathematics and be thus in the best interests of the Union, the adherence of the People's Republic of China should in no way be detrimental to the position of the member China–Taiwan. The commitment to this principle made the solution of the problem of China time-consuming and difficult for the IMU.

In the IMU discussions began, first between President Montgomery, Past President Chandrasekharan, and Secretary Lions. Lions told Montgomery of the proposition made by representatives of Beijing that the following resolution be voted: "The Academia Sinica (Beijing) applies to be the National Adhering Organization (NAO) of China to IMU. Mathematicians from Taiwan would also be represented by this NAO." Lions had asked two members of the French National Committee for Mathematics how they would vote in such a situation; both had said that they would vote yes. However, the IMU took no action.

In 1978 the Chinese Embassy in Paris approached Secretary Lions with two comments. First, the Chinese expected the IMU to get in touch with them, adding that not doing anything was a political choice. Second, they repeated the previous view that they would not like to see Taiwan expelled; they considered that the whole Chinese mathematical community, now falsely represented by Taiwan, should be represented by Beijing. The Chinese mathematicians of Taiwan would then be represented on an individual basis [285]. The IMU Executive Committee, even though eager to see the People's Republic of China as a member, did not hasten developments. The question of China appeared for the first time in the minutes of the Executive Committee meetings in 1979. With no formal application for membership from the People's Republic of China, it was decided "not to take action at present."

A couple of years earlier I had approached the Chinese Embassy in Helsinki in connection with the ICM-1978. As I could not comply with their wish that mathematicians from Taiwan not be invited, I was given to understand that the attendance of mathematicians from the People's Republic of China was not likely. No one came from there to Helsinki, in spite of the fact that one of the invited speakers was from Beijing.

The 1978 IMU General Assembly exhibited marked interest in China and accepted a resolution in which the Executive Committee was requested to continue its efforts to convince the People's Republic of China to become a member of the Union. A couple of months later, the stand of Beijing was forcefully expressed in a letter sent by the Acting Chairman of CAST (China Association of Science and Technology) to Sir John Kendrew, the Secretary General of ICSU. "As is known to all, there is only one China in the world, that is, the People's Republic of China; Taiwan is one of China's provinces and an inalienable part of her territory. Some leading members of certain international organizations take our Taiwan Province for a "country" or a "region" which is separated from the territory of China. This is what we are firmly opposed to because it is not in conformity to the fact and completely wrong, wittingly or unwittingly catering to meet the political needs of a few people who deliberately attempt to create "two Chinas" or "one China, one Taiwan" [286].

In the following year, 1979, remarkable progress was made by the International Union of Biochemistry (IUB). The People's Republic of China had joined the IUB in 1956, but after the admittance of China–Taiwan in 1965 had withdrawn its membership. When a new Chinese Biochemical Society was founded in Hangchow in May 1979, it immediately announced its willingness to join the IUB. After discussions held between the IUB Executive Committee; the delegates from the Academia Sinica, Taiwan; and representatives of the Chinese Biochemical Society; an agreement was reached in July 1979. Its main points were that for the time being, there would be two Adhering Bodies for China. Their membership should be designated as follows: Headline "China" and the two subtitles "The Chinese Biochemical

Society" and "The Biochemical Society of Taipei, China." As soon as this pact was concluded, the news was released to the press that China would become a member of the IUB and that it was hoped that the achievement of the IUB would be a breakthrough enabling China to join many other international bodies [287].

Encouraged by this progress, two other Unions—the International Union of Pure and Applied Chemistry (IUPAC) and the International Astronomical Union (IAU)—negotiated similar agreements with Beijing and Taipei in 1979. The People's Republic of China became a member of IUPAC on 1 January 1980 and of IUB on 1 March 1980. In both cases the listing of the Adhering Organization from Taipei was so changed that the words "of Taipei" were replaced by "located in Taipei." A successful formula had been found.

In the IMU, President Carleson and Secretary Lions were kept informed about these developments. Contacts between the IMU and China were in their hands. At this stage, the Executive Committee was not much consulted. In November 1979 Lions approached the Academia Sinica in Beijing inquiring whether the IUB formula could be applied in the case of the IMU as well [288]. Carleson used as a liaison with Beijing a Chinese mathematician who had visited the Mittag-Leffler Institute. In March 1980 he wrote to Carleson that the agreement reached with the IUB could indeed serve as a model for the IMU [289]. In consequence, Carleson suggested to Lions that an official letter, signed by both of them, should be sent forthwith to Taiwan with the request that Taiwan also approve of an "IUB agreement." It seems that such a letter was not dispatched. Instead, Lions wrote to Professor Hua (Fig. 10.10) in Beijing, referring to the model the IAU was attempting to have ratified with Beijing and Taipei [290]. A month later Lions approached Taipei with a similar letter. Unfortunately, the IAU nomenclature in the listing of the Adhering Organizations was not the same as the one used by the IUB and IUPAC, as was remarked by Beijing. Neither was Taipei pleased with the proposed listing.

After the summer of 1980, the IMU's chances for a quick solution à la IUB and IUPAC were gone. The United States had established diplomatic relations with the People's Republic of China in 1979, but in March 1980 the U.S. Congress passed the "Taiwan Relations Act," signaling to Beijing that Taiwan had not been forgotten. The sale of arms to Taiwan was recommenced. Beijing protested strongly [291]. In the scientific world, the attitude of the People's Republic of China stiffened. Having been about to join ICSU, as it seemed, it withdrew its candidacy. In October 1980, the Chinese Mathematical Society in Beijing recommended to the IMU a formula that would have transferred the representation of China from Taipei solely to Beijing. With obvious doubts about the success of this formula, Beijing at the same time proposed that the word "national" be deleted from the Statutes of the IMU, since China–Taiwan could not have a National Adhering Organization or a National Committee for Mathematics [292].

FIGURE 10.10. Loo-keng Hua (1910–1985). President of the Chinese Mathematical Society 1951–1983, who opened the dialogue between the IMU and China in 1955 and was contacted again by the Union in the 1980s. He died a year before China became a member.

The IMU was not yet ripe for this. President Carleson wrote, "I would hate to have a change of statutes again at a General Assembly. In any case, let us now wait [293]. This opinion found support among the members of the Executive Committee.

After the active months March–October 1980, a long period of calm followed, during which the membership of China was not discussed in the IMU. The case of China was activated again in May 1982 by two simultaneous actions.

First, the Executive Board of ICSU made public a draft resolution for its General Assembly to be held in the autumn [294]:

> Acknowledging that there is only one China and that Taiwan is a province of China, ICSU accepts the application of the China Association of Science and Technology (CAST) as a National Member. Following the admission of CAST as a National Member, the status of the Academy located at Taipei, China, will be studied by an ad hoc commission which will be asked to recommend an appropriate membership for the Academy located at Taipei, China, and the nature of any amendments to the

> ICSU Statutes required to achieve this. The Academy located at Taipei, China, will retain its present membership in ICSU, including its present voting rights, until a revised version of the Statutes has been adopted.

Thus the ICSU Executive Committee proposed that the People's Republic of China should be accepted as a member of ICSU without determining the position of the Republic of China, which would be discussed later. This procedure was in contrast to the principle adopted by the IMU that the membership of China should be based on an agreement accepted by the three parties concerned—the IMU, Beijing, and Taipei. Immediately after the publishing of ICSU's draft Resolution, Beijing informed Lions that a resolution analogous to "There is only one China and Taiwan is a province of China" should be passed by the IMU.

The General Assembly of ICSU accepted the suggested resolution at its meeting, which was held in Cambridge, England, in September 1982. However, an important clarification was added: "References as to the appropriate form of membership of the Academy located in Taipei, China, and to the future status of the Academy... mean that any Revision of the Statutes proposed should not exclude the Academy located in Taipei from membership or voting rights" [295].

In the spring of 1982, the IMU had received promising signals from Beijing, which showed interest in the Warsaw ICM. Encouraged by this and wanting to advance the question of membership before the handling of the ICSU draft Resolution in September, Carleson and Lions decided to act. A letter was sent to Beijing and Taipei in May 1982 in which the following agreement was proposed: "The National Adhering Organization and the National Committee of China would consist of representatives of two organizations, (i) The Chinese Mathematical Society, Beijing, P.R.C. (ii) The Mathematical Society located in Taipei, China" [296].

Since Taipei did not accept this formula, the membership of China was not considered by the IMU General Assembly in Warsaw in August 1982. However, following the Union's request, the People's Republic of China sent observers to Warsaw. Many contacts were made by the representatives of the IMU with members of this delegation, as well as with the delegates from China–Taiwan. The discussions were also attended by Lee Peng-Yee, a delegate of Singapore, who was President of the South-East Asian Mathematical Societies. It was agreed that both parties would consult with their respective organizations and that after receiving answers, the IMU Executive Committee could proceed on the matter.

In Warsaw the achieved accord was such that a final solution appeared to be near. However, later correspondence revealed that the agreed-upon nomenclature satisfied neither party. The problem caused by the word "national" in the Statutes of the IMU was thoroughly discussed at the meeting of the Executive Committee in November 1982. The President and the Sec-

retary were authorized to send letters to the Chinese parties asking their approval for the proposition to replace in the Statutes "National Committee for Mathematics" by "Committee for Mathematics." If both agreed, the proposition would be sent to the members for preliminary approval. The change in the Statutes would be taken up at the next General Assembly [297].

The response to the letter of Carleson and Lions was not satisfactory. There were still disagreements about the nomenclature. Preferring greater symmetry in its listing of the members, the IMU postponed for several years the adoption of the formulation used by the IUB and IUPAC. But more serious was another condition, one that had been overlooked before. Beijing now explicitly required that "National Adhering Organization" should be replaced by "Adhering Organization." This would have meant a much larger amendment to the Union's statutes than deleting the word "national" in connection with the Committee for Mathematics. Beijing also insisted on a declaration of the IMU that there is only one China and that Taiwan is part of it [298].

The first condition alone, the deletion of the word "national" entirely from the statutes, was enough to block all progress. At the meeting in May 1983, the Executive Committee of the Union took a negative stand. This was the first meeting of the new Executive Committee, many of whose members had not been involved with the problem of China. The philosophy, "The procedure of adherence should be the same for all, take it or leave it" could be felt. President Moser informed CAST that the new Executive Committee was not prepared to propose changes to the statutes [299].

The reaction from Beijing was not favorable. The People's Republic of China withdrew its participation in the Warsaw Congress. Nothing was heard from Beijing until March 1984, when Wu Wen-Tsün, the new President of the Chinese Mathematical Society, in a letter to Moser reiterated the conditions under which the People's Republic of China could join the IMU. There was no mention of a declaration, whereas the deletion of the word "national" was required as before. The listing was the same as the one used by the IUB and IUPAC [300].

The IMU Executive Committee made one more attempt to solve the problem without amending the statutes. At its meeting in May 1984, it decided to recommend to the member countries that the following resolution be made: "The term 'national' as used in the Statutes and By-Laws has no connotation other than denoting a member admitted under the provision of IMU-Statute 3." Moser informed Wu about this decision, adding that if this formulation would make it possible for China to join the IMU, the move would be initiated without delay [301]. The negative answer from Wu came a month later: "The Chinese Mathematical Society will maintain its original ground" [302].

During 23–28 September 1984, I attended the meeting of the ICSU General Assembly in Ottawa as the representative of the IMU. This offered a

good occasion to clarify the position of China. Delegates were present from Beijing and Taipei, and it was possible to learn about the status of China in other Unions, of which we had no clear picture in the IMU.

Part of the initial information I received was confusing and even wrong, as it turned out later. But there was enough time to check and crosscheck the information so that the true picture emerged. Of the twenty Unions belonging to ICSU, the People's Republic of China was a member in sixteen at the time of the Ottawa meeting. Of the four remaining Unions, two gave assurances that the People's Republic of China would join them in 1985, and the Beijing delegates confirmed this. This left two, of which the case of the International Union of Pure and Applied Physics (IUPAP) was complicated, as the membership of the People's Republic of China was part of a package deal whose aim was to readmit at the same time China–Taiwan to IUGS and IUGG. There remained only the IMU.

In several discussions with Wu Ganmei, head of the delegation of the People's Republic of China, I tried in vain to find a solution that would not require the deletion of the word "national" from the statutes of the IMU. At this point she was adamant and referred to the fact that all other Unions in which China had recently become a member or in which membership was pending had made or decided to make this amendment to their statutes. For the listing, she recommended the old IUB formula. When I pointed out that delegates of Taipei preferred a slightly different version, she said that personally she did not think the form of listing to be very important, but she had to follow instructions from her Foreign Ministry. She let me understand that the Chinese mathematical community was eager to join the IMU. The difficulties were of a political nature, and I understood that using Chinese mathematicians as intermediaries would be of no avail. In conclusion, I got the impression that the People's Republic of China would become a member of the IMU if and only if the IMU would drop the word "national" from its statutes.

Of my discussions in Ottawa I wrote a four-page report, which was distributed to the members of the Executive Committee. Having explained the relation of China to the other Unions, I wrote, "In the light of this situation, I think that we should reconsider the question of whether to change our statutes by deleting the word 'national.' My personal opinion now is that we should do this change. Members of the Taiwanese delegation said that they had nothing against the change" [303].

By the end of January 1985, all members of the Executive Committee had responded to my letter concerning China. Everybody was then in favor of recommending to the General Assembly that the word "national" be deleted from the statutes. This decision was confirmed at the meeting of the Executive Committee in May 1985. A detailed memorandum was drafted by which the member China would have two Adhering Organizations, the Chinese Mathematical Society and the Mathematical Society located in Taipei, China. The first mentioned would have three votes and

pay four units, while the second would have two votes and pay two units. The memorandum was sent to Beijing and Taipei for final approval [304].

A prompt positive answer came from Beijing. In contrast, no response was received from Taipei for a while, and when it finally came in September 1985, it was not entirely in the affirmative. In the IMU memorandum they were listed according to the old IUB formula, "The Mathematical Society located in Taipei, China." Instead of this, Academia Sinica, Taipei, wanted "The Mathematical Society of China (Taipei)." A long correspondence about this minor detail followed. Since Taipei would not yield, Beijing was asked whether they could agree to the modification desired by Taipei. When the answer was negative, the Executive Committee at its meeting in April 1986 decided to recommend its China memorandum of May 1985 for acceptance by the General Assembly. Taiwan was not happy about this, but its reaction could be interpreted as reluctant consent.

Prior to the IMU General Assembly, which was held in Oakland, California, 31 July–2 August 1986, the position of the member country China–Taiwan was not yet clear, and on the day preceding the opening of the meeting, President Moser and I spent a good amount of time in discussions with their delegates. We pointed out that the exceptionally scrupulous way in which the IMU alone had handled the problem of China should convince our colleagues from Taiwan that the proposed arrangement would not restrict their autonomy in the IMU in any manner. They would be free to use the official name of their society in all their business. Moser and I emphasized how unfortunate it would be if the terms of the membership of China would be a result of a public ballot, with China–Taiwan in opposition. No agreement was reached. But the same evening, at the cocktail party for the General Assembly, the delegates from China–Taiwan approached Moser and me to tell us that they had decided to accept the IMU form of listing. Thus the last step had been taken towards a solution. The General Assembly reached a unanimous decision that made China a member of the IMU under the terms stipulated in the 1985 memorandum of the Executive Committee.

A remarkable feature of this arrangement was how Beijing and Taipei divided the five votes (and number of delegates) in Group V: three for Beijing and two for Taipei. China–Taiwan had been in Group I, with one vote and delegate, so that the new arrangement actually meant a rise in its status.

In the everyday life of the Union, the consequences from amendments to statutes have been small. The IMU Secretariat follows scrupulously the new rules and uses the terms "Adhering Organization" and "Committee for Mathematics" in official publications. But in common parlance the additional word "national" is still widely used in this context. The 1994 IMU General Assembly, for example, spoke repeatedly about "National Committees."

11
The IMU and Related Organizations

The IMU is a Scientific Union Member of the umbrella organization ICSU, with which it is connected in many ways. Until the mid-1970s, the activities of the IMU depended essentially on the subventions it received from ICSU.

The Union has itself formed permanent subcommissions with terms of reference of their own: the International Commission on Mathematical Instruction (ICMI), in 1952; the Commission on Development and Exchange (CDE), in 1978; and, jointly with the International Union of History and Philosophy of Science, the International Commission on the History of Mathematics, in 1987. In addition, the IMU has been increasingly interested in establishing contacts with organizations representing applied mathematics or fields close to mathematics.

11.1 The IMU as a Member of ICSU

The principal objective of the International Council of Scientific Unions (ICSU) is to encourage and promote international scientific and technological activity for the benefit and well-being of humanity. At its foundation in 1931 as a successor of the International Research Council, ICSU adopted the principle of unrestricted internationalism and saw no reason to alter this policy when it resumed its activities after the Second World War. In its present formulation, ICSU affirms the rights and freedom of scientists throughout the world to engage in international scientific activity without

regard to citizenship, religion, creed, political stance, ethnic origin, race, color, age, or gender.

The enormous expansion of scientific research after World War II is reflected in the growth and enhanced profile of ICSU. In 1995, it had twenty-three Scientific Union members—that is, international, disciplinary organizations—and ninety-two National members, which are multidisciplinary scientific academies, research councils, scientific institutions, or associations of such institutions. In addition, ICSU had twenty-eight scientific associates. ICSU seeks to break the barriers of specialization by initiating and coordinating major international interdisciplinary programs and by creating interdisciplinary bodies that undertake activities and research programs of interest to several members.

At present, the principal source of ICSU's finances is the contributions it receives from its members. Other sources of income are the subvention from UNESCO and grants and contracts from other United Nations bodies [305].

The relation of the IMU to ICSU has been ambivalent: ICSU has been indispensable and yet peripheral. The connections with ICSU and its predecessor IRC have always been close. The first step towards the foundation of the IMU was taken in 1919 at the constitutive meeting of the IRC, where the draft statutes of the Union were approved and an Interim Executive Committee elected. When the IMU came into being with the adoption of the statutes by the national delegations of mathematicians in 1920, the report of the Secretary stated as a matter of course that the IMU was a Union of the IRC. The General Assembly of the IRC, held two years later, confirmed the submission of the IMU to the IRC. After the transformation of the IRC into ICSU in 1931, the IMU automatically became a member of ICSU. The adherence was short-lived, however, ending a year later with the suspension of the IMU.

When preparations for reestablishing the IMU began after the Second World War, it was taken for granted that the new IMU would join ICSU. As related in Section 4.1, Marshall Stone informed ICSU's President about the plans to reconstitute the IMU even before formal contacts were taken with mathematicians outside the United States. In the first drafts of the statutes of the IMU, a seat was reserved in the IMU Executive Committee for a representative of ICSU. The first IMU General Assembly, in March 1952, decided to apply for the Union's adherence to ICSU. In October 1952, the IMU was again a member of ICSU, after a break of twenty years.

The membership of the IMU in ICSU can be seen as necessary for the general reason that mathematics cannot be isolated from other sciences. And as related in Section 5.1, the founding fathers of the new IMU had a compelling reason to hasten adherence to ICSU: In the early years, financial support from ICSU was indispensable.

During 1953–1959, the UNESCO subvention through ICSU made up about sixty-five to seventy percent of the Union's annual income. In 1960 the amount sank to just below fifty percent, but it was up to sixty-six per-

cent again in the Congress year 1962. During 1963–1969 it varied between thirty-seven and fifty-one percent, jumping to sixty percent in the year of the ICM-1970. These contributions were always earmarked for specific purposes. Up to 1975, the scientific activities of the IMU depended essentially on subventions from UNESCO/ICSU. In 1975, the UNESCO/ICSU contribution dropped to below thirty percent and, with the financial position of the IMU gradually improving, kept on decreasing. During the four-year period 1986–1989, direct contributions from ICSU constituted twelve percent of the income of the Union. The actual UNESCO/ICSU support to the Union was higher, because some of their subventions were allocated directly to the subcommissions of the IMU, outside the bookkeeping of the Union.

Ideologically, the IMU had no difficulty in adapting itself to the role of a union of the ICSU family: Like ICSU, the new IMU had assumed a policy of unrestricted internationalism. In 1958 ICSU solidified this policy when its General Assembly in Washington approved the following statement: "To ensure the uniform observance of its policy of political non-discrimination, the ICSU affirms the right of the scientists of any country or territory to adhere to or to associate with international scientific activity without regard to race, religion, or political philosophy.... ICSU and its dependent organisms will take all necessary steps to effect these principles." At the same meeting, the term "country," although broadly defined in the statutes of ICSU already in 1931, was further clarified. The IMU profited immediately from this explicit formulation of ICSU when the membership of China–Taiwan caused problems of a political nature (Section 6.2).

In 1973, a brief note in the IMU *Bulletin* introduced ICSU's Standing Committee on the Free Circulation of Scientists. The following year, the ICSU General Assembly in Istanbul adopted a Resolution that set forth an important objective of this Committee. Having been informed of a number of cases in which bona fide scientists had been prevented from attending Symposia organized and sponsored by ICSU Unions through the refusal of the host country to grant entry visas, the Assembly recommended the adoption of certain guidelines in the organization of such Symposia. An assurance in writing should be obtained from the organizers in the country concerned that visas would be granted if proper applications were made. The unfortunate consequences that might arise through failure to grant visas should be communicated to the organizers. And then came the sanctions part of the Resolution: "Arrangements for future meetings in any country found unable to comply with these principles should be suspended until more satisfactory circumstances exist" [306].

The recommendation soon became a rule adopted by all ICSU Unions. The 1978 IMU General Assembly resolved formally to endorse the ICSU Resolution. It asked "the Executive Committee to do their best to implement the spirit and the letter of this Resolution, paying special attention

to the attendance of invited speakers and other participants at the ICM and other scientific gatherings sponsored by IMU" [241].

The ICSU Resolution on the free circulation of scientists turned out to be of importance. In several cases, the possibility of being able to refer to a prestigious world organization led to the granting of visas that had first been refused. For instance, Soviet scientists could be helped if they had difficulties in entering a Western country. However, the Resolution did not cover those cases in which the USSR denied their own scientists permission to leave the country.

In the IMU, the existence of a simple, formal rule was often a great relief. From time to time, the IMU was approached with requests to join various petitions or networks to correspond about matters concerning human rights. Usually, the Union found it best to refer such cases to ICSU, which had set up special bodies for this purpose. In spite of this, the IMU also became directly involved with questions related to human rights. Considerable correspondence was carried on, especially during Moser's presidency, 1983–1986.[1]

In the 1970s and 1980s, problems arose in particular with scientists from the Republic of South Africa. The example given in Sections 9.4 and 9.6 showed how the ICSU Resolution helped the ICM-1978 to avoid a difficult situation. Later, the position of South Africa caused a problem in ICMI (see Section 11.2), and it was discussed in the CDE (Section 11.3).

A real menace to the Union arose prior to the ICM-1990, which was to be held in Kyoto, Japan. In accordance with the sanctions enacted by the United Nations, Japan had prohibited citizens of South Africa from entry into Japan for the purpose of cultural exchange. However, an exception could be made for meetings associated with ICSU if the scientists signed their application for a visa including the statement: "I do not hold any racial prejudice nor do I belong to any racially discriminatorial organization." The Standing Committee on Free Circulation of Scientists of ICSU felt that this requirement was against the principles of ICSU. The problem had surfaced when ICSU was invited to hold its General Assembly in Tokyo in 1988. The working group set up to interpret the practical applications of ICSU's nondiscrimination principle issued a report stating, "The fact that some governments uphold policies that are abhorrent and highly discriminatory cannot justify external discrimination against scientists that live in those countries." Ultimately, ICSU rejected the invitation of Japan. The repudiation affidavit required by Japan was against ICSU's principles, because it imposed conditions on the granting of a visa that required the affirmation of personal views by individual scientists from some countries only. Essential were the last words "from some countries only." In reporting

[1] In the Archives of the IMU, a whole section is devoted to the material related to human rights (see the Appendix, Section 13).

about this decision, ICSU's President Kendrew added the remark: "However, we will not instruct this interpretation to the union members of ICSU. Each Union has the liberty of making its own decisions."

The interpretation of the nondiscrimination principle became a prime topic of discussion at the ICSU General Assembly in September 1988, which took place in Beijing (instead of Tokyo). The IMU representative at the meeting was H. Komatsu, who, understandably, did all he could in order to save the Kyoto ICM. The resolution that was adopted after a long discussion reconfirmed the nondiscrimination principle without specifying its interpretation in new terms. Thus the IMU had no compelling reason to revoke the decision to hold the ICM-1990 in Japan. The Union was a stout defender of the nondiscrimination principle but found that in this case, South African colleagues were not discriminated against in such a way as to warrant cancellation of the ICM. It was felt, in agreement with President Kendrew, that "Statutes are our slaves and we are not slaves of the Statutes" [307].

The presence of the IMU in ICSU, even though self-evident and beneficial to the Union in many ways, has not been without its problems. In brief, the IMU has not always felt at home in ICSU. Meetings of the General Assembly and the General Committee are large events that easily become frustrating for participants who do not belong to the inner circle of the ICSU Council. Delegates of the IMU have even expressed complaints about ICSU meetings in written form.

The underlying reason for the discomfort of the IMU at ICSU derived from the type of scientific activities that are the main concern of ICSU. The Council initiates, designs, and coordinates major interdisciplinary research programs, such as the International Geophysical Year (1957–1958), the International Biological Program (1964–1974), or the International Geosphere–Biosphere Program launched in 1986. ICSU also creates interdisciplinary bodies whose activities comprise the interests of several members, for instance, Antarctic, oceanic, space, and water research; problems of the environment; genetic experimentation; solar–terrestrial physics; and biotechnology.

Such activities were remote to the IMU, which at its best has played only a minor role in them. To a large extent, mathematics has been an outsider in ICSU. At meetings of the General Committee, the Unions were divided into two working groups. For years, one was called the group of Earth, Space, Chemical and Physical Sciences; the other that of Biosciences. As representative of the IMU at the General Committee of ICSU, I protested against the omission of "Mathematics" in the title of the first group. Finally, I wrote to the Executive Secretary of ICSU: "I did not see Mathematics mentioned in connection with the Working Groups. Is IMU excluded from this activity?" [308]. After that, mathematics was added to the long name of the first group. It is customary that the representatives of the Unions give a short talk in which they describe important recent achievements of

their disciplines. This is an interesting part of the meeting of the General Committee. But mathematics is often in a more difficult position than the others when it is a matter of attracting general interest.

ICSU has a Committee on the Teaching of Science (CTS), to which the IMU can appoint a member. Even there, life has not always been easy. In the 1970s, the IMU representative was Hans Freudenthal. His devotion to educational questions and his expertise in this field were beyond doubt. He was a member of the ICMI Executive Committee for eight years and President of ICMI in 1967–1970. When he resigned the CTS, his farewell letter to the IMU President Deane Montgomery was murderous:

> My term as a representative in the ICSU Committee on Teaching Science will expire at the end of 1978. It will be the end of my activity in the international field of Mathematics and Mathematical Education. During the whole activity I never experienced such frustration as I did in ICSU CTS. The reason why I tell you this is that if ever you think about nominating a successor, you may be able to warn him. ICMI knows more details. It is my firm opinion that IMU should leave the ICSU Committee on Teaching Science. There are a number of reasons. First, most unions represented in ICSU CTS are only interested in university-level education. Second, mathematics education has no input or output in this committee. Third, mathematics is not considered as a science proper by the majority, and the most influential ones, but rather is met with deep distrust, which I understand but do not approve of [309].

However, there are also many examples of IMU's positive contacts with ICSU. First of all, over many years the IMU was exceptionally well represented in the Council. Chandrasekharan, who served for twenty-four years on the Executive Committee of the IMU and served as President and Secretary (Section 5.5), was Vice-President of ICSU and after that held the office of Secretary General in 1966–1970.

In 1958, ICSU created a Joint Commission on Space Research (COSPAR), which the IMU joined three years later. A delegate was appointed by the IMU Executive Committee with the task of assembling a group of mathematicians interested in space research. This first approach seems not to have brought results. Later, two of the Union's Presidents, Moser and Lions, served as scientific liaisons between the IMU and COSPAR.

After the establishment of the IMU Commission on Development and Exchange, a natural link was created between the IMU and the ICSU Commission on Science and Technology in Developing Countries (COSTED).

The trend in the IMU to devote additional attention to applied areas of mathematics has brought the Union nearer to ICSU. In 1986, ICSU launched the International Geosphere Biosphere Program, its largest scientific venture so far. At the initiative of Lions, the IMU joined this program

three years later and appointed Hörmander, Lax, and Lions as liaisons. This move of the IMU was welcomed in ICSU with special attention. Instead of ignoring mathematics, expectations of the possibilities provided by mathematical methods were rather overoptimistic. The election of Jacob Palis, Secretary of the IMU since 1991, to the Executive Board of ICSU in 1993 and as Vice-President in 1996 further reflected strengthened ties between the IMU and ICSU.

11.2 ICMI as a Subcommission of the IMU

The activities of the International Commission on Mathematical Instruction (ICMI) and its predecessor, the International Commission on the Teaching of Mathematics, have been described in three previous sections: the first active years 1908–1914 in Section 1.3, the second period 1928–1939 in Section 3.2, and the first steps after 1952 as an infant subcommission of the IMU in Section 5.4.

The subsequent years under the IMU marked a period of strong expansion. A.G. Howson, the Secretary of ICMI in 1983–1990, has written a concise history of ICMI covering the seventy-five years 1908–1983 [310]. The text is an expert's view, containing a wealth of information. In this section a brief account will be given of ICMI's relations to the IMU—how ICMI grew up to become a semiautonomous part of the Union.

The terms of reference of ICMI in 1960 did not differ much from those adopted by the 1954 General Assembly of the IMU (Section 5.4). However, as mentioned before, an additional paragraph was of importance: "The Commission may, with the approval of the Executive Committee of the IMU, coopt, as members of ICMI, suitably chosen representatives of non-IMU countries, on an individual basis."

This was an opportune time to make this addition to the rules. Many former colonies were becoming independent, and education was seen as a vital factor in the development of these new nations. In 1994, there were twelve countries that were members of ICMI but not of the IMU. This possibility to belong to ICMI also created a link between ICMI and the CDE (Commission on Development and Exchange).

The first years of the new ICMI were full of challenges. With increasing economic prosperity, educational systems were expanding rapidly. World War II had disclosed new possibilities and new opportunities for applications of mathematics. Large changes were taking place within mathematical education. The effect of Bourbaki on university curricula was felt everywhere. In the United States, the first flight of Sputnik resulted in the launching of the nationally financed School Mathematics Study Group. Radical changes in school mathematics were proposed in several countries. "The new math" became a household word [310].

ICMI took an active part in these developments. However, it felt that the imbalance between the need to act and the resources at its disposal was increasing. Stone, who had been elected President of ICMI for the four-year period 1959–1962, called special attention to this in his report to the 1962 IMU General Assembly. A small annual subvention from the IMU's own funds covered the most essential operating expenses of the offices of the President and the Secretary of ICMI. Each year a larger subvention was provided out of funds made available to the IMU by ICSU for the organization of scientific meetings. The amount varied from year to year. ICMI sought to set up a separate fund of its own, through voluntary contributions from countries represented in it. This fundraising was not successful: Only the modest sum of $425 could be collected during the years 1959–1962. The financial means available to ICMI remained insufficient. At that stage, the IMU could not do much to remedy the situation.

Stone was succeeded by A. Lichnerowicz as President of ICMI for 1963–1966. He faced the same problem as his predecessor: "It is one of the most thankless tasks of the executive committee and its president to search for financial support from outside organizations. The constant need from across the world for information and exchange of knowledge can only be met through the establishment of an adequately financed permanent secretariat." To this the 1966 General Assembly of the IMU took a vaguely positive stand: "Considering the importance, and the increasing complexity, of ICMI, the General Assembly recommends that the Executive Committee of the Union study the question of the creation of a permanent Secretariat for ICMI."

Freudenthal, who took office as President of ICMI at the beginning of 1967, and his Executive Committee repeated the call for a permanent secretariat. The new IMU has had a secretariat, albeit a small one, from the very beginning of its activities in 1952. At that time, the financial resources of the Union were meager. Thanks to Secretary Bompiani, a helping hand was then offered by the University of Rome, as related in Section 5.2. This proved to be an all-important precedent. Ever since, the country of the Secretary has assumed a good part of the costs of the IMU Secretariat.

From the loud voicing of worries in the 1960s, the conclusion can be drawn that ICMI was not always as fortunate as the IMU. For a long time, ICMI's activities visibly suffered from a lack of adequate administration. This was the case, for example, in the years 1979–1982, when Whitney was President and Hilton Secretary. Their professional competence was in striking contrast to the Commission's inefficient administration. The ICMI *Bulletin*, of which six issues had been published in the years 1975–1978, when Iyanaga was President and Kawada Secretary, ceased to appear. In 1982 Whitney stressed on the one hand the weakness of ICMI and on the other the enormous importance of the development and education of children and students [311]. The administrative situation improved later when

support came from the home country of the Secretary and, considerably more than previously, from the IMU.

The active President Freudenthal felt strongly that the profile of ICMI had to be raised. In his opinion, *L'Enseignement Mathématique* no longer served adequately as a journal of communication among mathematics educators. Therefore, ICMI assisted in the creation of a new journal, *Educational Studies in Mathematics*, for which it signed a contract with UNESCO.

A second initiative taken by ICMI was much more important. Freudenthal was of the opinion that the role of ICMI at the International Congresses of Mathematicians was far from one of real significance. What was required, he argued, was a congress devoted solely to mathematics education at which invited talks could be given and opportunities for personal contributions presented. The Executive Committee of ICMI accepted the idea. Thanks to financial subventions from the French Government and UNESCO, the first International Congress on Mathematical Education (ICME) was held in Lyons, France, during 24–30 August 1969. This was a landmark in the history of ICMI, the more so as it was decided to make ICMEs a permanent institution by arranging them regularly, every four years between the ICMs. The Congresses of the 1910s had been revived (cf. Section 1.3).

The first ICME was organized without any connection with the IMU. In his enthusiasm, Freudenthal had neglected to keep the Executive Committee of the IMU abreast of developments. At the meeting of the IMU Executive Committee held in Paris in May 1968, President Cartan and Secretary Frostman complained of the lack of information about the activities of ICMI. It was recalled that the President of the IMU is a member ex officio of every Committee of the Union. The Executive Committee had not been told of the creation by ICMI of the new journal *Educational Studies in Mathematics*, which seemed to compete with *L'Enseignement Mathématique*. A financial contract had been signed between ICMI and UNESCO without the IMU having been informed. And to quote the minutes of the meeting verbatim, "it seems that ICMI decided to hold an international congress in Paris in 1969" [312].

From the point of view of the Executive Committee of the IMU, the child had come of age and behaved accordingly. Yet the parent was understanding. At its meeting in 1969, the IMU Executive Committee, after ventilating its feelings about insufficient contact with ICMI, formulated its basic policy as follows: "The IMU should continue its policy of paying special attention to educational questions through ICMI, in order to ensure that the creative mathematician and the educator do not work isolated from each other."

At this stage and later, ICMI relied heavily on support from UNESCO, which in addition to ICMEs has been cosponsoring many other ICMI conferences and study projects. ICME 2 was held in Exeter, England, in 1972; ICME 3 in Karlsruhe, Federal Republic of Germany, in 1976; and ICME

4 in Berkeley, California, in 1980. The popularity of these Congresses rose steadily, as indicated by the following statistics: At ICME 1, in Lyons, there were about 650 participants from forty-two countries; at ICME 2, in Exeter, there were almost 1,400 members from seventy-six countries; at ICME 3, in Karlsruhe, the number of participants was over 1,800, again from seventy-six countries. At ICME 4, in Berkeley, there were 1,800 full members and 450 associate members from almost ninety countries.

Owing to a lack of traditions, the first Congresses had widely differing programs. Lyons had twenty-one plenary addresses and a number of short communications by Congress members. Exeter had forty working groups and seventeen presentations by national subcommittees. The Karlsruhe ICME was divided into thirteen sections, which together covered most aspects of mathematics education; while Berkeley, with over 400 speakers, returned in part to the Lyons scheme but also had a variety of discussion groups. Some of the working groups set up at Exeter continued to meet at Karlsruhe. This led to the decision to make the International Group for the Psychology of Mathematical Education and the International Study Group on the Relations between the History and Pedagogy of Mathematics independent groups affiliated with ICMI.

Irrespective of their particular form, the Congresses had an activating effect on ICMI. This was felt at the national subcommission level. Also, thanks to the ICMEs, more emphasis was shifted directly to individuals. (Thousands of educators attended ICMEs, and ICME Proceedings probably had many more readers than the ICMI Bulletins and Reports.)

Discussion at ICME 1 revealed that language was a much bigger problem than at the ICMs: Mathematics education imposed greater linguistic demands on the speaker and hearer than did the presentation of mathematics. Mathematics educators lacked largely the international terminology and vocabulary of the mathematician and could not resort with equal facility to a universal set of symbols.

The organization of ICMEs was soon seen as the major task of ICMI. They were to be planned for the level of teachers of teachers. Once again, the need to clarify the general position of ICMI and its relation to the IMU was felt. In 1982, the long-time Vice-President of ICMI, Bent Christiansen, formulated it as follows: "ICMI should not be seen as powerful leaders of the development in mathematics education. In fact, the Commission and its EC should not decide what are proper or relevant solutions to problems in our field. But there was urgent need for a structure under which interaction and exchange of views can be facilitated." This was in conformity with the policy of the Teaching Commission preceding ICMI. (Cf. Fehr's statement in Section 3.2.) Christiansen continued that the large group of professional mathematics educators demanded an organization to take care of its needs, and it would be unfortunate if such an international body were formed outside the auspices of the IMU. He found the situation perilous. If ICMI could not provide the type of leadership and structure corresponding to

the needs and interests of the growing mathematics education community, then an organization independent of the IMU might easily be created [311].

The vast differences in the aims and organization of the first four ICMEs gave rise to ICMI's new Executive Committee in 1983 to study the future ICMEs: Congresses after ICME 5 in 1984, in Adelaide, Australia, whose preparations were already well advanced. The new President was J.-P. Kahane (France) and the new Secretary, A.G. Howson (U.K.). (As they were reelected at the 1986 General Assembly of the IMU, they were in charge of the activities of ICMI for eight years, during 1983–1990.) The ICMI Executive Committee agreed that new planning of the Congresses should be adopted, in order to develop effective international involvement and also to decrease the administrative load on the host countries. The philosophy resembled that adopted by the IMU at the end of the 1950s with respect to the ICMs, as did the concrete proposal that the ICMI Executive Committee appoint an International Program Committee consisting of ten persons, of whom two to four would come from the host country. The appointments would be made at the Executive Committee meeting held at the preceding ICME. The Program Committee would have the duty of approving the academic program of ICME [312]. This procedure was followed for the first time at ICME 6, which was held in Budapest in 1988, with well over 2,000 participants.

The introduction of ICMEs independently of the IMU meant an essential increase of ICMI's sovereignty as a subcommission of the Union. Nonetheless, ICMI is a part of the IMU and so a member of the ICSU family. This became manifest in 1986, when a movement began to bar the Republic of South Africa from the activities of one of ICMI's affiliated study groups. This would have been in violation of ICSU's nondiscrimination policy. The IMU made it clear to ICMI that deviation from ICSU's policy would not be permitted. The problem was discussed at a meeting of the Executive Committee of ICMI. The decision of those members of the Executive Committee present was that ICMI should abide by ICSU's rules and so should affiliated study groups.

The meeting condemned the apartheid policies of the South African regime. There was no consensus on how a body such as ICMI should react to this particular situation. In order to carry forward the debate and to bring conflicting views into the open, it was agreed that members of the Executive Committee should have the opportunity to put forward their personal views in the ICMI Bulletin of June 1986. This possibility was utilized by Vice-President Christiansen. In his long article "An argument in favour of changing the present ICSU rules" he analyzed the situation, using as his starting point the thesis that South African apartheid was not a political issue, but a question of human rights. Secretary Howson, in spite of having much understanding for Christiansen's views, arrived at the conclusion, "The matter is not easy, but on balance I fear we have much more to lose than to gain from banning South Africans" [313].

During the Kahane–Howson period 1983–1990, ICMI was very active. An innovation was the establishment of "ICMI Studies," devoted to particular topics of contemporary concern. They led to some widely distributed and discussed documents and reports. Among the topics were "The influence of computers and informatics on mathematics and its teaching," "Mathematics as a service subject," "School mathematics for the 1990s," "The popularization of mathematics," and "Mathematics and cognition."

The IMU budget for 1987–1990 reflected a tangible recognition of the work of ICMI on the part of the Union. First, the annual subvention for the administrative expenses of ICMI was raised from 4,000 Swiss francs to 9,000. In addition, an amount of 15,000 Swiss francs per year was allocated to the free use of ICMI for scientific activities. This was a new practice, since previously, ICMI had been in the same position as organizers of conferences on special topics (cf. Section 5.5). That is, specified applications to the IMU Executive Committee were required for its scientific projects. (This option ICMI preserved, in addition to its unspecified "own" money.)

A constant worry in ICMI is that contacts between the ICMI Executive Committee and the National Representatives are far from satisfactory. "Who are the National Representatives? How do they react to [the ICMI] Bulletin? Do they pass on the information? There are many of whom we do not know whether they are living or dead." These are quotations from retiring President Kahane's "Farewell Message" of 1990.

In the same Message, Kahane analyzed the relations between the IMU and ICMI.

> Now, why is ICMI a commission of IMU and not an independent organization? There are historical and formal reasons. The majority of our financial support comes from IMU, or from ICSU via IMU. However, in my opinion, the fundamental reason is the intimate link between mathematics and its teaching. In no other living science is the part of *mis en forme, transposition didactique*, so important at a research level. In no other science, however, is the distance between the taught and the new so large. In no other science has teaching and learning such social importance. In no other science is there such an old tradition of scientists committed to educational questions. In particular, professional mathematicians were involved in the "new math" initiative when mathematics along with other sciences stressed structural aspects. The situation is different now. Mathematics interacts more strongly with other sciences and technologies, mathematicians are looking outside mathematics, many are oriented towards industry, finance, management; the relative importance many place on teaching and on thinking on educational problems is seemingly decreasing. It is time to draw the attention of mathematicians again to educational problems,

some of which need to be approached with the extended view of what mathematics is now" [314].

Mathematical competitions have become important in promoting mathematics at all levels of education. It was conservatively estimated in 1990 that at least ten million students throughout the world each year attempted a mathematics competition of some kind. These competitions aim at motivating, challenging, encouraging, and identifying students who are interested or talented in mathematics. More generally, they strive to stimulate interest in learning and popularizing mathematics.

International Mathematical Olympiads (IMOs), which are arranged each year, have developed into truly worldwide events. By 1990, sixty-one countries from all continents had participated in them. In 1996, a record seventy-five countries took part in the IMO.

The first IMO was organized in Braşov, Romania, in 1959. Until 1965, participating teams were only from Socialist countries. Their Ministries of Education decided in which order each country should host an Olympiad. When Western countries started to join the IMOs, the problem arose of how to choose the sites. In 1980, no host could be found for the competition [315, 316].

A solution to the problem was provided by the 1980 General Assembly of ICMI, which decided to set up an IMO Site Committee. Its sole task was to ensure that annual IMOs were held and to assist the host country. The appointments of the members to the Site Committee usually followed nominations by the IMO jury. Although ICMI has no responsibility for financing and organizing the Olympiads, a link was thus created between it and the IMOs. Recently, this connection has been strengthened. The Site Committee has been renamed the IMO Advisory Board and given a wider role in the arrangements concerning the IMOs [317].

11.3 Commission on Development and Exchange

The IMU took its first organized measures towards the promotion of mathematics in the Third World in the early 1970s. In Section 9.1 an account was given of how an International Group was established in 1971 to assist the Executive Committee of the Union in matters dealing with mathematics in developing countries. The next step was to set up Regional Groups in 1974. In this connection the Constitution of the Union's Exchange Commission was changed so that the coordinators of the Regional Groups, as well as the Secretary of the Union, became its members.

This was not merely a formal amendment. During the four-year period 1975–1978, the Exchange Commission under the chairmanship of the Canadian A.J. Coleman devoted many of its activities to questions related to developing countries. In particular, the Commission succeeded in obtain-

ing from the Canadian Development Agency (CIDA) a grant for support of the All African Mathematical Conference, held in Rabat, Morocco, in July 1976. At Rabat, the African Mathematical Union (AMU) was created. The AMU became the liaison between the IMU and the African mathematical community. Immediately after its establishment, the Exchange Commission requested and received for the AMU a sizable grant from CIDA for organizing a conference on Pre-University Mathematics in Africa.

Y. Kawada, Chairman of the Asian Sub-Committee of the Commission, studied the possibility of holding a similar conference in Asia. Financial difficulties inhibited progress on this idea. As Coleman remarked, the Commission had accomplished a few useful things but had scarcely begun to find ways by which mathematicians in developed countries could encourage and help their colleagues in developing countries. "Without funds available to hold meetings of the Commission, it is very difficult to generate ideas and enthusiasm or to make plans" [318].

An administrative measure of decisive importance was taken by the 1978 General Assembly. It decided to establish the Commission on Development and Exchange (CDE), as related in Section 9.5.

The Terms of Reference of the CDE accepted in 1978 underwent slight amendments in 1986:

> By the present Terms, the Commission shall consist of a Chairman and ten other members, including the outgoing Chairman of the CDE, the President and Secretary of the IMU and the representative of the IMU at COSTED (ICSU) [the ICSU Commission on Science and Technology in Developing Countries].
>
> The rules for the election of the Commission are similar to those of the IMU Executive Committee and of the ICMI Executive Committee, with the same Nominating Committee. The IMU Executive Committee shall request proposals for the membership of CDE from the Committees for Mathematics and will conduct extensive consultations with the existing CDE before proposing slates to the Nominating Committee.
>
> The Commission shall elect, from among its members, a Secretary who shall act also as its Treasurer, unless the Commission appoints another member for that purpose.
>
> Acting in accordance with the Statutes and By-Laws of the Union, and the administrative policies of the Union, as determined by the Executive Committee, the Commission shall
>
> (a) support and encourage the growth of Mathematics in developing countries and cooperate with appropriate bodies to that end;

(b) support the exchange of visits with member countries of the Union in which, for one reason or another (e.g. nonconvertible currencies), such exchanges are not easy to arrange;

(c) advise and assist existing agencies working towards the same objective with due regard to the nongovernmental and non-political nature of IMU and to its administrative policies, and without duplicating or prejudicing the work of other Commissions and Committees of IMU at points of common interest [319].

In addition to the resolution on the foundation of the CDE, the 1978 General Assembly accepted two more resolutions that concerned developing countries. One of them expressed disappointment in the role of ICSU and a wish for improvement. Eight years later, in 1986, the General Assembly expressed its gratitude to UNESCO and ICSU for the help and support that these organizations had provided to various mathematical activities. It pointed out, however, that the funds currently allocated to the UNESCO research and higher education program in mathematics seemed quite insufficient to respond to the needs of the international community, in particular those of developing countries.[2]

The other resolution outlined the financial policy of the Union towards the CDE: "The General Assembly does not propose an increase in IMU dues, but proposes a special appeal for contribution to finance development activities..." [320]. This resolution reflected the basic philosophy of the IMU in relation to the implementation of development activities. While prepared to work wholeheartedly for the promotion of mathematics in developing countries, the Union was not willing to include the financial implications of such activities in the part of the budget based on income from dues. Activities endorsed by the IMU should be financed by UNESCO, ICSU, or various development agencies and the like.

When the IMU started scientific activities in the 1950s, the situation had been similar. Sponsoring mathematical conferences had been possible only thanks to subventions from ICSU and UNESCO. With the years, the financial independence of the Union gradually increased, and the same was to happen in the case of the CDE.

Apart from contributions from outside bodies, the IMU launched a campaign among its own members for donations to promote scientific activities in developing countries. A Special Development Fund was established by the General Assembly in 1978, and an appeal was sent to all National Adhering Organizations and Committees for Mathematics. They were requested "to give generously to ensure the success of this valuable initiative." The target was set at 25,000 Swiss francs per year.

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[2]During the period 1988–1991, the CDE did receive additional financial support from UNESCO.

During the first ten years, the outcome was disappointing. In 1979, donations totaled 2,498 U.S. dollars. In 1980 they were $6,756 and in 1981, $3,636. The main donors were Finland (a partial return of the IMU subvention for the ICM-1978), the Federal Republic of Germany, and Italy [321]. Between 1982 and 1988 the contributions were even lower than in the beginning, around 3,500 Swiss francs per year. The largest donations came from the London Mathematical Society and Wiskundig Genootschap, the Netherlands, smaller amounts from the mathematical societies of Australia, Denmark, Finland, Norway, and Sweden.

The year 1988 marked a turning point. The Special Development Fund received large contributions from the American Mathematical Society; IMPA, Brazil; and the Royal Society, U.K. These contributions exceeded 25,000 Swiss francs. In 1989 the total was also well over 20,000 Swiss francs, the American Mathematical Society alone providing 17,265 [322]. The upward trend has continued in the 1990s, thanks to the American Mathematical Society, which asks its members for a voluntary contribution when collecting annual dues. The original target of 25,000 Swiss francs per year has been well exceeded: In 1994, donations amounted to almost 85,000 Swiss francs.

These funds are for travel grants to young mathematicians from developing countries or from soft-currency countries to make possible their participation in the ICMs. The distribution of the travel grants was assigned to a four-person committee. One of its members was from Africa (the President of the African Mathematical Union), one from Asia (for many ICMs, M.S. Narasimhan, from India), one from Latin America (J. Palis), and the Secretary of the Union as coordinator and for the Socialist countries of Europe. While serving in the committee I was struck by the committee members' unswerving demand on quality: Only deserving cases could be supported even if it meant geographical asymmetry or unspent money.

The report of Hogbe-Nlend, the Chairman of the CDE, to the 1982 General Assembly of the IMU provided an overview of the activities of the Commission during its first four-year period 1979–1982 [323]. The CDE was especially interested in countries that were not members of the IMU, and there it directed its action. Two kinds of help, scientific and financial, were given to support mathematical activity in Africa, Asia, and Latin America.

The aim was to support three scientific activities, one on each continent, and also to try to assist regional gatherings of mathematicians. In Southeast Asia, the CDE worked with SEAMS (South-East Asian Mathematical Societies), in Africa, with the African Mathematical Union, which was in direct contact with UNESCO for coordinating mathematical activities and creating seminars. There was no exact counterpart for these organizations in Latin America. Apart from the Brazilian Congress of Mathematics, which invited mathematicians from all of South America to its meetings, Hogbe-Nlend mentioned the Latin-American School of Mathematics ELAM. In

the years to come, the support of the CDE to Latin America was channeled in large part through the conferences of ELAM. ELAM was connected with the Inter-American Commission on Mathematical Education, through which a link was created with ICMI.

Building mathematical libraries in developing countries was an important objective of the CDE. In 1982, Hogbe-Nlend could say that an international program had been launched to collect mathematics books and send them to countries that needed them and that about one thousand books had been so dispatched. The CDE report covering the period 1983–1986 mentioned the plan proposed by J. Dieudonné to constitute a Selective Bibliography for libraries in developing countries. Its first draft had been published in 1985 [324]. However, by the CDE report of 1990, the expectations attached to creating libraries had not been met: "The CDE has been looking into the possibility of running an ambitious Regional Library Program. Its main idea would be to create at carefully chosen places a library which, in exchange of a recurrent support to buy books, would accept to help mathematicians of its region have access to bibliographical information. To have any impact, this program requires obtaining a very substantial support which the CDE has not presently been able to gather" [325].

The CDE has not been able to create international regional centers of its own, for which preliminary plans were made already in the early 1970s. On the other hand, important among the activities of the CDE is cooperation with two existing centers, the International Center for Pure and Applied Mathematics, which is located in Nice, France, and the International Center for Theoretical Physics, in Trieste, Italy. These centers hold research schools and training courses in pure and applied mathematics for mathematicians from developing countries.

The IMU has relaxed its 1978 policy of not using money from its budget for financing the activities of the CDE. In addition to donations, the Union now allocates a sizable annual subvention to the CDE. As related above, the Special Development Fund is growing remarkably. Attempts are being made to set up contracts with ICSU and UNESCO on a long-term basis. All in all, the IMU is intensifying its efforts to promote mathematics in developing countries. In 1992, the Union announced the goal that by the year 2000, most countries that are members of UNESCO should reach a level of mathematical research that would enable their admission to the IMU (cf. Section 12.5).

11.4 Problems in Africa

Henri Hogbe-Nlend had been elected the first President of the African Mathematical Union (AMU), in whose creation he had been instrumental. This achievement spoke for him at the election of the first Chairman of the

IMU Commission on Development and Exchange, in 1978. He was thought to be particularly suitable for this office, as the promotion of mathematics was seen as particularly difficult in Africa. Subsequent developments soon proved that Africa was a problem area indeed.

No alarming news came to the IMU from Africa during the first four-year period of the CDE, with the exception of the fact that the AMU General Assembly was not summoned and the Pan-African Congress not organized as the stipulations of the AMU would have required. Hogbe-Nlend was reelected Chairman of the CDE by the IMU 1982 General Assembly. His election was the first exception to the practice that Presidents and Chairmen of the Union's Commissions serve only one four-year period.

Unexpectedly, for the IMU Executive Committee at least, a new organization, the International Committee on Mathematics in Developing Countries (ICOMIDC) was set up, primarily on the initiative of Dr. Joséphine Guidy Wandja, from the University of Abidjan, Ivory Coast. The constitutive meeting of ICOMIDC was held in Warsaw in 1983 at the time of the International Congress. Guidy Wandja was elected President, and L. Lorch (Canada) and B.L. Sharma (India) Vice-Presidents. Supporting organizations, such as the U.S. Committee for Scientific Cooperation with Vietnam and the Friendship of Nations University of Moscow, as well as certain active individuals with known political affiliations, gave ICOMIDC a political flavor.

This constitutive meeting tried to create the impression of a connection with the Warsaw Congress. A relation with ICMI was seen in the presence of its President, Kahane. The accepted aims and objectives of ICOMIDC were virtually identical with those of the CDE. ICOMIDC was supposed to make contact with various organizations, including the IMU, ICMI, and UNESCO, but conspicuously, the CDE was not mentioned in the list [326].

Not surprisingly, a reaction came from Hogbe-Nlend in his capacity as Chairman of the CDE. He wrote to Guidy Wandja, *"Je tiens à vous préciser... que la seule structure permanente au sein de l'UMI chargée des pays en développement est la Commission Développement et Echanges."* (I want to make it clear to you... that the only permanent body within the IMU for developing countries is the Commission on Development and Exchange) [327]. The Secretary of the IMU also asked Guidy Wandja for an explanation of why she felt it necessary to establish the organization ICOMIDC and how she saw the activities of ICOMIDC in relation to the IMU [328].

Going its own way, ICOMIDC did not lose much time before it decided to organize an International Symposium, "Informatics and the Teaching of Mathematics in Developing Countries," in collaboration with the International Federation of Information Processing (IFIP). The Symposium was to be held in August 1985 in Yamoussoukro, Ivory Coast. For a while, the preparations proceeded well: UNESCO exhibited interest, and the Canadian Development Agency (CIDA) granted the Symposium 50,000 Cana-

dian dollars, to be paid through ICMI. Hogbe-Nlend expressed his great interest (*"le très vif intéret"*) in the Symposium, on behalf of the AMU and the CDE. This was first misinterpreted to have meant sponsorship on the part of these two organizations.

The Symposium in Yamoussoukro was duly announced by ICOMIDC and invitations to it dispatched. In February 1985, another Symposium in Yamoussoukro under the high patronage of His Excellency Félix Houphuet-Boigny, President of the Republic of the Ivory Coast, and with the support of UNESCO, was announced by Hogbe-Nlend. It had exactly the same dates as the ICOMIDC Symposium and practically the same topic. For "his" Symposium, Hogbe-Nlend had the support of the Mathematical Society of the Ivory Coast. As Chairman of the CDE, he took the liberty of mentioning the IMU as one of the organizers. His list of organizers also included IFIP, which he had not contacted. Since ICMI's President Kahane was sympathetic to ICOMIDC, IFIP was under the impression that ICOMIDC was "a subgroup of ICMI." The confusion was unbelievable. The Secretary of the IMU wrote in April 1985, "It took me some time before I realized that two separate conferences will be run in Ivory Coast simultaneously in August 1985."

The finale was in conformity with the preceding events. Two weeks before the conference(s) were scheduled to start, word came from the President of the Ivory Coast that no Symposia could be held there. Most of the participants of the ICOMIDC Symposium whose travel had been paid from the Canadian contribution had received their air tickets, and some were already on their way to the Ivory Coast. Ultimately, the CIDA-supported Symposium took place in Monastir, Tunisia, in February 1986.

By that time, Guidy Wandja had been replaced by Sharma as President of ICOMIDC. The Union and its Commissions ICMI and CDE distanced themselves from ICOMIDC. With not enough international support, the stamina of ICOMIDC began to fade, and finally, it ceased to exist. In addition to ICOMIDC, another "private enterprise" was introduced with aims similar to that of the CDE. F.K.A. Allotey, who held a position at the International Center for Theoretical Physics, in Trieste, founded an ICTP Society of African Physicists and Mathematicians.

Simultaneously with the perplexities caused by ICOMIDC and the episode of the Ivory Coast Symposia, a serious crisis developed within the African Mathematical Union. At the meeting of the Heads of Departments of Mathematics in African Universities held in Yaoundé, Cameroon, in 1983, it was felt that the Second Pan-African Congress of Mathematicians, long overdue, should be organized. Hogbe-Nlend asked countries to volunteer to host the Congress. In the following year Nigeria made a firm bid and chose Jos as the venue of the Congress. This decision was communicated to Hogbe-Nlend, who expressed his agreement in writing. The Nigerian Organizing Committee, headed by Aderemi O. Kuku, began preparations for the Congress.

Soon trouble started. A comprehensive account of the conflict between Hogbe-Nlend and the Nigerian organizers was presented by Kuku in a letter of November 1985, entitled "Appeal to the International Community to help prevail on Professor Hogbe-Nlend" [329]. At the same time, Hogbe-Nlend publicized his views on the developments [330]. The feelings of the Union can be read from the Secretary's letter to Kuku: "From the formal point of view, the African Mathematical Union is not part of IMU, nor has the second Pan-African Congress asked any support from IMU. Primarily, to put the African Mathematical Union on a healthy basis again is your internal problem. But of course IMU is very much interested in the activities of the African Mathematical Union" [331].

The main course of events after 1984 seems to have been as follows: In January 1985, Hogbe-Nlend sent a cablegram stating that in agreement with UNESCO and at the request of several departments of mathematics in Africa, the Executive of the AMU had decided to abandon all plans to organize the Congress. Kuku thereupon informed the members of the AMU Executive Committee and heads of departments of mathematics in all African universities of this decision, requesting comments. All replies received denied any part in Hogbe-Nlend's decision and encouraged the Nigerians to continue with their plans for the Congress. Allotey's ICTP Society also sided with Kuku. Work for the Congress in Jos was not interrupted, and Kuku asked Hogbe-Nlend to reconsider his stand.

In June 1985, Hogbe-Nlend expressed his agreement that the Congress should be organized in Nigeria in 1986. After he was told that the Congress would take place in Jos during 23–26 March 1986, Hogbe-Nlend indicated that the Executive Committee of the AMU should take the main decisions on this Congress, based on proposals coming from Nigeria and other African countries. Considering the current stage of the arrangements, this demand came late. The Nigerian Organizing Committee had already finished the draft program for the Congress, including a tentative list of speakers and coordinators of special areas. According to Kuku, this was all done "in consultation with mathematicians from all over the Continent." The First Announcement of the Congress was sent out, and Hogbe-Nlend was asked to endorse these measures on behalf of the AMU.

Instead of complying with this request, Hogbe-Nlend announced that the Congress in Nigeria would take place in three different locations—Lagos, Ife, and Jos—with the Secretariat for the Congress in a fourth place, Ibadan. From the extant documents, the conclusion can be drawn that the new plan was suggested without clearance from the universities concerned. No progress could be made in the direction of decentralizing the Congress in Nigeria.

Hogbe-Nlend now uttered his deep dissatisfaction with the Nigerian arrangements for the Congress. In his opinion they penetrated areas for which the Executive Committee of the AMU had sole authority. In October 1985 Hogbe-Nlend announced that the Congress would be held in Yaoundé,

Cameroon, and he arranged a meeting of the Executive Committee of the AMU there [329]. Hogbe-Nlend presided, but only five of the twelve members were present. The published document "Decision on the 1986 Panafrican Congress" was confusing. It first said that the Executive Committee appreciated the official offer of the Government of Cameroon and the University of Yaoundé to host the 1986 Panafrican Mathematical Congress. But a few lines later, Hogbe-Nlend and the Nigerian Vice-President, R. Ohuche, were empowered to negotiate with the Nigerian Federal Government conditions for the possible successful organization of the Congress in Nigeria [332].

Local Cameroonian mathematicians helped Kuku to reestablish the Nigerian Congress site. Just before the meeting, the Head of the Mathematics Department of the University of Yaoundé had informed Kuku that Hogbe-Nlend had not been in any contact with them and had completely surprised all mathematicians in Yaoundé. "The Congress was organized without the least participation... and without any agreement of the Department of Mathematics" [333].

What ICMI's Secretary Howson wrote to President Moser in December 1985 illustrates the feelings in the Union:

> Basically, the position in Africa is impossible. We had the farce of two "computer" meetings in Abidjan, neither of which took place. We now have two Pan-African Congresses announced. ICOMIDC has been established to do the job of CDE, and IMU through ICMI now finds itself in the position of supporting a "breakaway" organisation by obtaining funds for them via ICSU. In an attempt to "unravel" the situation, yet another organisation, the ICTP Society, has been created, this time with the backing of the Trieste centre, again financed with UNESCO money [334].

However, in the beginning of 1986, the crisis was over. Without support from his African colleagues, Hogbe-Nlend was unable to pursue the plan to hold the Congress in Cameroon, and he informed Kuku that he had canceled the Yaoundé Congress. The Second Pan-African Congress of Mathematicians took place as scheduled, in Jos, Nigeria, in March 1986. At the decisive moment, disagreements were buried. The Nigerian Committee, striving to promote the spirit of unity, asked Hogbe-Nlend to be the Chairman of the opening session. Hogbe-Nlend not only participated in the Congress, but he arrived a few days early to attend the meeting of the Nigerian Committee, where final touches were put to the preparations. The Congress was regarded as having been "very successful." At the General Assembly of the African Mathematical Union, which convened at the time of the Congress, Kuku was elected the new President of the AMU. Hogbe-Nlend remained in the Executive Committee as immediate Past President (Fig. 11.1) [335].

FIGURE 11.1. Aderemi Kuku (Nigeria) and Henri Hogbe-Nlend (Cameroon), the two first Presidents of the African Mathematical Union. The photograph is from the Pan-African Congress of Mathematicians at Ifrane, Morocco, September 1995, where President Kuku ceremoniously honored his predecessor (and sometime opponent) Hogbe-Nlend as a pioneer in the development of mathematics in Africa.

In the same year, Hogbe-Nlend's chairmanship in the CDE terminated. At the 1986 General Assembly of the IMU, M.S. Narasimhan, from Bombay, India, became his successor. Hogbe-Nlend had already served two four-year terms. In the aftermath of the 1984 International Congress on Mathematical Education in Adelaide, serious disagreement had developed between ICMI's President J.-P. Kahane and Hogbe-Nlend, which endangered cooperation between ICMI and the CDE. Kahane was reelected President of ICMI in 1986.

The same year, 1986, Hogbe-Nlend became President of the International Center of Pure and Applied Mathematics (CIMPA), in Nice. Active as before, he started to prepare a Third World Mathematics Congress; the word spread that it would be held in Dakar, Senegal. For financial support, Hogbe-Nlend was in direct contact with UNESCO. (In addition to the title "President of CIMPA," he used "Consultant to the Director General of UNESCO.") But again, he had acted on his own, without having consulted key organizations such as the IMU, the CDE, and the AMU. To clarify the situation, a "Meeting of expert mathematicians on UNESCO programmes"

was held in Nice in June 1987. In addition to Hogbe-Nlend and A. Marzollo, who represented UNESCO, present were the Secretary of the IMU; the Chairman of the CDE, Narasimhan; and the President of the AMU, Kuku. Marzollo was told that even though the IMU/CDE does not have and does not want to have a monopoly on activities that aim at promoting mathematics in developing countries, UNESCO should always keep in mind that there is an international organization, CDE, for this purpose that enjoys the backing of the world's mathematical community. According to the report of the meeting, "it was felt that there was no need to have a scientific congress exclusively restricted to mathematicians from developing countries, which would duplicate the role of the International Congress of Mathematicians" [336].

After 1986, viewed from the IMU, the African mathematical community worked without friction. At this time, the news media paid increasing attention to events in the Republic of South Africa. During the 1986 International Congress at Berkeley, I discussed with Kuku the principle of free circulation of scientists in the case of South Africa. The long discussion ended with Kuku's promise that the AMU would not boycott mathematical conferences on account of South Africa, and this pledge was kept. The ban on South African mathematicians was lifted at the third Pan-African Congress of Mathematicians, in 1991 [337]. Soon afterwards, the elimination of apartheid ended the whole problem. All-African mathematical activities were strengthened when South African mathematicians could participate in them.

In terms of participation in the ICMs, the development of mathematical research in Africa fell short of expectations. Maximum representation was attained at the 1978 Congress in Helsinki, where seventy-six African mathematicians from twenty-four countries were in attendance. After that, participation from Africa decreased, in spite of increased support from the IMU and other sources. At the ICM-1986 in Berkeley there were forty-three African mathematicians from eleven countries, while at the ICM-1990 in Kyoto these figures were forty-one and fifteen. Academic activities have suffered from political and economic difficulties.

11.5 The IMU and the History of Mathematics

At the first International Congresses of Mathematicians, the history of mathematics had a visible role. The mathematical program of the ICM-1897 in Zurich was divided into five sections: arithmetic and algebra, analysis and theory of functions, geometry, mechanics and mathematical physics, and history and bibliography. Of the thirty listed lectures, three belonged to the section "history and bibliography."

At the ICM-1900, the sections 1–5 were as in Zurich; to these a new, sixth, section, "teaching and methods," had been added. The program of the opening session comprised, apart from customary addresses of welcome, two lectures both dealing with the history of mathematics. At the ICM-1904, the Congress adopted a resolution assigning the history of mathematics "a fitting place in public education" at both university and secondary-school levels.

The basic pattern of the mathematical program of the ICMs underwent only small formal changes until the year 1974. In the years 1900–1970 (except for the 1966 Moscow Congress), the number of sections varied between six and eight. At the ICM-1970 in Nice there were six sections, entitled mathematical logic, algebra, geometry and topology, analysis, applied mathematics, and history and teaching. Four years later, at the ICM-1974 in Vancouver, the number of sections jumped to twenty, as sections that had grown very large were subdivided into smaller parts. At the ICMs 1978 (Helsinki), 1983 (Warsaw), and 1986 (Berkeley) there were nineteen sections, and in 1990 (Kyoto) eighteen. The sections at the ICM-1990 were as follows:

1. Mathematical logic and foundations
2. Algebra
3. Number theory
4. Geometry
5. Topology
6. Algebraic geometry
7. Lie groups and representations
8. Real and complex analysis
9. Operator algebras and functional analysis
10. Probability and mathematical statistics
11. Partial differential equations
12. Ordinary differential equations and dynamical systems
13. Mathematical physics
14. Combinatorics
15. Mathematical aspects of computer science
16. Computational methods

17. Applications of mathematics to the sciences

18. History, teaching, and the nature of mathematics

Over the years, the role of the history of mathematics has continually decreased, becoming very small. The figures of the ICM-1978 (Helsinki) and ICM-1986 (Berkeley) speak for themselves. In Helsinki, only one of the 119 invited lectures in the sections dealt with the history of mathematics; in Berkeley, these figures were one out of 148. In 1986, the spontaneous interest in the history of mathematics was higher than the "official" one: Of the 731 short communications presented in Berkeley, 14 were classified as belonging to "history of mathematics."

The small interest in the history of mathematics at the ICMs has been compensated for by other developments. The International Union of the History of Science had been founded in 1947, and in 1956, the International Union of the History and Philosophy of Science (IUHPS) was created by the federation of the History Union and the International Union of Philosophy of Science. The two federating bodies became two divisions of the IUHPS: the Division of the History of Science and the Division of the Philosophy of Science.

According to its statutes, the aims of the IUHPS are to establish and promote international contacts among historians and philosophers of science and scientists who are interested in the history and foundational problems of their discipline; to collect documents useful for the development of history and philosophy of science; to encourage and sustain research and study of important problems in these fields; and to organize and support international conferences, symposia, and other forms of scientific exchange.

Each Division of the IUHPS has its own membership and organization, and each organizes international congresses at four-year intervals. During the intermediate years between these congresses, an International Joint Conference of mutual interest is organized by representatives of both Divisions.

In 1968 the Division of the History of Science set up an autonomous Commission on the History of Mathematics. When the Commission was in the process of founding an international journal, *Historia Mathematica*, the chairman of the Commission, Kenneth O. May, approached the IMU. In a letter of February 1972 to Secretary Frostman, he wrote, "When the Commission was first formed in 1968 we hoped that it would maintain close relations with both the mathematical and historical communities. I feel very strongly that the history of mathematics is too important to be left to historians." May made two concrete proposals: 1. The IMU might agree to be a "sponsor" of the journal. This would entail no financial responsibility but would simply be a token of interest and moral support. 2. The IMU might wish to name a representative to the Commission on the History of Mathematics and/or to the editorial board of the journal [338].

This approach did not awaken much enthusiasm within the IMU. In July 1972, Frostman answered May that the question of sponsoring the periodical *Historia Mathematica* had been discussed at the meeting of the Executive Committee of the IMU but that no decision had been taken. "It is an inter-Union matter, namely between IUHPS and IMU, and I think that a contact and discussion between these two Unions should take place before any decision can be taken" [339]. The files of the IMU do not indicate any further contacts between the IMU and the IUHPS at that time.

In the early 1980s, the International Commission on the History of Mathematics approached the IMU again. A concrete reason was the Summer Workshop on the history of mathematics, which was held in July–August 1983 at the University of Toronto. Of this the IMU was informed, with the request for financial support [340]. The IMU responded positively by granting the Workshop $2,000.

A dialogue had been opened between the IMU and the IUHPS. At its Congress in Berkeley, in August 1985, the Division of the History of Science voted to approve the establishment of the joint Commission on the History of Mathematics with the IMU, "to further strengthen the ties between the historians of mathematics and the working mathematicians." The IUHPS expressed the wish that a positive decision about this be made by the IMU in Berkeley, in connection with the ICM-1986 [341].

For some reason, the IUHPS chose a roundabout way for its contact with the IMU, and it took a year before their wish was brought to the Executive Committee of the IMU. The first letter informing the Secretary of the IMU about the planned joint Commission was dated 25 July 1986. It reached me only after the meeting of the Executive Committee had been held in Oakland on 30 July [342]. There was then no longer any possibility of alerting the General Assembly of the Union.

The important thing was, however, that the IMU was now willing to become a partner of the Commission on the History of Mathematics. At the meeting in Leningrad on 22–23 May 1987, the IMU Executive Committee decided to recommend to the members of the IMU that a Joint Commission on the History of Mathematics be established with the Division of History of Science of the IUHPS. A postal ballot was arranged in October 1987, and all votes received were in favor of creating this joint Commission [343]. Jean Dhombres (France) and Harold Edwards (USA) were appointed representatives of the IMU to the Executive Committee of the Joint Commission.

With this decision, the IMU became a participant in new activities related in various ways to the history of mathematics. In this same direction were also the wishes expressed by the IMU Executive Committee in 1990 that the archives of the Union should be arranged and catalogued and the history of the IMU written [344].

11.6 The IMU and Applied Mathematics

As long as organized international cooperation in mathematics has existed, the questions related to the interplay between basic research and applications have been discussed. The first lecture of the first International Congress of Mathematicians in 1897, given by Poincaré, dealt with the relations between pure analysis (*l'analyse pure*) and mathematical physics. "A science developed exclusively with applications in view is impossible; the truths are not fruitful unless they are enchained with each other. If one is attached only to those [problems] of which an immediate result is expected, the intermediary links are lacking, and there is no longer a chain" [345]. Klein, the first President of ICMI's predecessor, the International Commission on the Teaching of Mathematics, was said to have been motivated in his work in mathematical education by the endeavor to prevent mathematical instruction from losing touch with the education demanded by engineering science.

In the nineteenth century mathematical research had gradually emancipated itself from seeing in mechanics and astronomy the ultimate goal of the exact sciences. A division between "pure" and "applied" mathematics arose, and the need was recognized for a discussion of the nature and purpose of mathematical research [4, 346].

During the first half of this century, it was increasingly felt that mathematics should be studied for its own sake, without regard for its roots or applications. The tendency to abstraction gained ground. World War II rekindled interest in applied mathematics, and in the second half of the century the rapid growth of advanced technology in the industrialized world began to generate an increased need for applied mathematics and an array of new and interesting problems. The proliferation of computers greatly magnified this development.

Since its establishment, the IMU has been obligated by its statutes to encourage and support international mathematical activities considered likely to contribute to the development of mathematical science in any of its aspects—pure, applied, or educational. The explicit mention of applied mathematics has not remained an empty gesture. The IMU has always paid attention to applied areas and, following general trends, shown keen interest in them from the beginning of the 1970s and even more since the 1980s.

The traditional neighbor of mathematics, theoretical physics, attracted the interest of the new IMU right from its formation. Contact was immediately established with the International Union of Theoretical and Applied Mechanics (IUTAM). In 1952, delegates of the IMU attended the General Assembly and Congress of IUTAM. Reciprocity was observed, and a representative from IUTAM attended the second General Assembly of the IMU, in 1954. There the following resolution was accepted: "This Assembly requests the Executive Committee to explore, in consultation with IUTAM,

the desirability of making a proposal to ICSU to appoint a joint Commission of the IMU and the IUTAM for carrying on specific activities of common interest; and to take appropriate action thereon" [347].

This resolution led nowhere. In fact, it seems that after 1954, contacts between the IMU and IUTAM were broken for almost twenty years. In the early 1970s, theoretical physics again became part of the IMU's activities. In 1972 the Union sponsored an International Conference on Mathematical Problems of Quantum Field Theory and Quantum Statistics, which was held in Moscow at the initiative of N.N. Bogoliubov. The success of the conference encouraged further meetings on mathematical physics under the sponsorship of the IMU. In the years 1972–1983, seven such IMU conferences took place, usually every other year. The series was discontinued after the 1983 meeting in Boulder, Colorado.

Parallel to this development, contact was reopened with IUTAM. The first joint IMU/IUTAM Symposium on Applications of Methods of Functional Analysis to Problems of Mechanics was held in Marseille, France, in 1975. The decision was made to continue organizing such joint Symposia; the second meeting took place in Novosibirsk, USSR, in 1978. For securing a more permanent collaboration, IUTAM suggested to the IMU that a Joint Standing Committee for the Interaction between Mathematics and Mechanics (JSCIMM) be established. Each Union would appoint four representatives to JSCIMM with terms of office of four calendar years [348]. Secretary Lions presented the proposal to the IMU Executive Committee, which assumed a cautious stand. Eventually, it was decided to set up a Joint Committee on an informal basis, consisting of three representatives of both Unions. The IMU representatives were Lax, Lions, and Marchuk. An organization outside the IMU and IUTAM, the International Society for Interaction of Mathematics and Mechanics, volunteered to be a permanent liaison, but neither of the Unions involved wanted such an arrangement. For some reason or other, direct cooperation between the IMU and IUTAM again ceased after the Novosibirsk Symposium.

While contacts with IUTAM receded, another organization, the International Association of Mathematical Physics (IAMP), grew increasingly interested in cooperation with the IMU. The IAMP had started organizing International Conferences every three years. At its meeting in Marseille in 1986, the Executive Committee of the IAMP decided to seek an affiliation with the IMU. "The relations between mathematics and mathematical physics have always been very strong, and today they are probably stronger than they have ever been before" [349]. The IAMP did not specify the legal form of this affiliation. The Executive Committee of the IMU discussed the proposal at its meeting in 1987, under the chairmanship of President Faddeev, himself a mathematical physicist. The reaction was positive, but faithful to its conservative policy, the Executive Committee shunned formal obligations. The answer to the IAMP was formulated as follows: "IMU considers closer cooperation with IAMP very useful. The members of IMU

are countries and the Union has not any provisions for associate members or affiliated members. We propose, therefore, that our organizations start their cooperation in an informal manner. For this purpose the Executive Committee nominated Professors Ludwig D. Faddeev and Jürgen Moser as contact persons on our side" [350]. Informal arrangements do not necessarily live long, and the IMU–IAMP collaboration experienced the same fate as the other joint ventures with physicists: It soon came to an end.

At the time of the founding of the new IMU, there was already considerable awareness of the potentialities of computers. In those years computers were large and expensive, and it was believed that their efficient use for scientific purposes could best take place in large centers. It was thus natural that the IMU became very much interested in the participation of the planning of the International Computation Center under the auspices of UNESCO. The files of the first years of the IMU contain considerable correspondence about this project, which ultimately faded (Section 5.3).

A quarter of a century later, concrete interest in computer science, which had grown enormously and become a discipline of its own, was revived in the IMU. There was a world organization, the International Federation of Information Processing (IFIP), which was a Scientific Associate of ICSU that organized large international congresses. The Executive Committee of the IMU became convinced that it would be in the highest interest for mathematics not to lose contact with computer science and that some special steps should be taken. This was emphasized particularly by Lennart Carleson, who had become President of the IMU at the beginning of 1979.

Carleson wished first to investigate whether the publicity around Fields Medals could be utilized by requesting the Fields Medal Committee not to forget mathematical computer science when choosing recipients of the awards. In order to form an impression of the practical consequences of such an idea, he asked some leading experts to assess the chances of researchers in mathematical computer science winning a Fields Medal. The answers were not encouraging: Theoretical computer science was a new subject that had not yet reached the level of maturity of many areas of mathematics.

Carleson then proposed that the IMU establish a new prize, similar to the Fields Medal, but specified for the mathematical aspects of computer science. The Executive Committee discussed this proposition for the first time at its meeting in April 1981. There was full agreement about the usefulness of enhancing the Union's relations with theoretical computer science. After some exchange of opinions, agreement was also reached about the prize and its form. It was decided that the prize should consist of a gold medal and a cash prize similar to the ones associated with the Fields Medal. The Executive Committee was of the opinion that in financing the project, commercial companies should not be involved. Soon it also became clear that the honor of sponsoring the prize should preferably be given to a small country. Thus Carleson's proposal to try to raise the necessary funds from Sweden, from the Royal Academy of Sciences, was readily accepted.

In order to be on the safe side, it was agreed that if funds could not be obtained in Sweden, then possibilities in Finland could be investigated.

Unexpectedly, Carleson met opposition in Sweden, whereas I succeeded in obtaining a positive decision from the University of Helsinki. Once the financial aspect was settled, the Executive Committee started pondering a suitable name for the prize. It turned out that all natural choices from Archimedes to von Neumann were already in use in some other connection. When members of the Executive Committee learned that Rolf Nevanlinna, who had been President of the IMU and Rector of the University of Helsinki, had taken the initiative in introducing computers to Finnish universities, the decision was made to name the prize after him. The name of the first winner of the Rolf Nevanlinna Prize, Robert Tarjan, was announced in 1982 at the IMU General Assembly in Warsaw, and the prize was presented to him at the Warsaw ICM a year later (Sections 10.3 and 10.4).

A little earlier, in 1979, a wish had been expressed on the part of computer scientists to have a higher profile at the ICMs. The European Association for Theoretical Computer Science proposed that Section 17, "Discrete mathematics and mathematical aspects of computer science," of the ICM-1978 be split into two sections: "Discrete mathematics" and either "Theoretical computer science" or "Mathematical foundations of computer science" [351]. Besides emphasizing the growth and ramification of theoretical computer science, the computer scientists could also refer to the increasing significance of combinatorics as justification for discrete mathematics having a section of its own. The proposal of the European Association was supported by the Association's American counterpart. The splitting was indeed done for the ICMs 1983 and 1986, and for the ICM-1990, the old Section 17 was replaced by three sections: Combinatorics, Mathematical aspects of computer science, and Computational methods.

From 1979 on, all Presidents—Carleson, Moser, Faddeev, Lions, and Mumford—have had a strong personal interest in mathematical applications. Carleson made his philosophy clear in his presidential address to the 1982 General Assembly of the IMU:

> In my opinion, IMU—in its present organization—overemphasizes pure mathematics and its teaching. There exist, besides us, two large international organizations in computer science, organizations in mathematical physics, in the history of mathematics, in probability, and probably more. The present Executive Committee has taken steps to collaborate with these organizations, but much more needs to be done. There are difficult borderline questions, but we must try to increase the relations to the applied areas and to counter a development whereby pure mathematics becomes isolated. In my opinion this question is of fundamental importance for the coming Executive Committee of IMU.

As a prelude to introducing the Rolf Nevanlinna Prize, Carleson then referred to the revolutionary role of the problems related to computers: "We are here in the beginning of a development where problems of a mathematical nature will relate essentially all aspects of life" [352]. (Cf. Section 10.3.)

President Moser represented similar views in addressing the 1986 General Assembly of the IMU:

> Four years ago, L. Carleson, in his presidential address, stressed the need for increased contacts of mathematics with neighboring fields of applications. I wish to reemphasize this concern which, in my opinion, is at least as urgent now as it was then.
>
> Traditionally, mathematics has always interacted strongly with various branches of science. It has served as an essential tool in many other fields and has in return received strong stimuli through these contacts. There are many examples illustrating this mutually beneficial effect. The work of J. von Neumann in the thirties on logic and computation had dramatic implications for the future development, as we all know. One can also think of the more recent work on the Yang–Mill's equation, originating in theoretical physics, which led to striking results on the topology of four-manifolds. Another example is the soliton theory, which started from numerical experiments and led to deep connections with infinite-dimensional Lie algebras.
>
> In many countries there has been serious concern about the decrease in the number of mathematics students in recent years. To deal with this problem and try to turn the tide, we should show young mathematicians the variety and promising connections with other fields mathematics can offer. The Union has already taken some steps in this direction.... In the future, the IMU should continue to pursue and intensify such outside contacts. In my opinion, it is essential for the health and vitality of our science to extend and cultivate our relations to other fields of applications [353].

At the ICM-1990, President Faddeev could express his satisfaction: "Personally, I was glad to observe how prominently Mathematical Physics was represented in its connections with other domains of Mathematics."

A remarkable feat of strength of applied mathematics was the First International Conference on Industrial and Applied Mathematics (ICIAM), held in Paris in 1987. It was attended by about 1,800 mathematicians from over fifty countries. There were sixteen invited speakers, sixty-nine minisymposia, and some fifteen hundred contributed papers. The Conference was co-organized by the Gesellschaft für Angewandte Mathematik und Mechanik, the Institute of Mathematics and Applications, the Society for

Industrial and Applied Mathematics, and the Société de Mathématiques Appliquées et Industrielles. This list alone spoke to the fact that a number of important organizations, national and international, had come into being in the vicinity of the IMU. The decision was made to continue arranging ICIAMs. For the IMU this means new challenges, since ICIAMs, more than ICMEs, overlap the ICMs. There was no formal tie between the IMU and the first ICIAM, but an Honorary President of ICIAM-87 was J.-L. Lions, who was Secretary of the IMU in 1975–1982 and was elected its President in 1990.

The nature of mathematics was analyzed in the Preface of the Proceedings of ICIAM-87 as follows:

> These Proceedings record the size, vigor, and explosive growth of applied mathematics. Mathematics is a live science; real-world phenomena provide its inspiration and nourishment. It then leaves this world for a formalization of the intrinsic properties of these phenomena, becomes aesthetical, and then cannot make further progress unless again exposed to reality. Mathematics needs a compass; otherwise, it loses its essence. All these steps are necessary, and there is no hierarchy among them [354].

12

The IMU in a Changing World (1986–1990)

The political movements that began in the mid-1980s changed the world profoundly. The Soviet Union disintegrated; the Cold War terminated; freedom was spreading; market forces were becoming ever more dominant. Just a taste of the influence of these developments on the IMU can be given in this presentation, which only occasionally extends beyond the year 1990.

The termination of the Cold War has facilitated East–West mathematical cooperation and has greatly diminished the need of the IMU as a mediator. In the 1990s, the number of members of the IMU increased, as countries that had become independent in the course of the political upheavals began to join the Union. Russia smoothly inherited the place of the USSR.

The lower East–West profile has been compensated for by the Union's intensified collaboration with the Third World. The allocation to the Commission on Development and Exchange in the IMU budget has increased substantially. In sponsoring special conferences, the IMU is concentrating more than ever before on developing countries and on countries with currency restrictions.

The Union's main scientific occupation, the International Congress of Mathematicians, now free from the former politically and ideologically charged environment, is as important as ever. At the turn of the millennium, the IMU plans to provide a vision for mathematics in the twenty-first century, in analogy to what Hilbert did for the twentieth century in the year 1900.

The effects of the changing world on scientific research have been intricate and not so easy to assess. In many countries, the trend has been to reduce or reallocate public spending on science, for economic or ideological reasons,

or both. In conjunction with a utilitarian philosophy, this has contributed to a shift of resources from fundamental research to the applied sciences. In mathematics, the relative position of applied areas has strengthened noticeably.

12.1 The 1986 General Assembly in California

Preparations for the 1986 General Assembly followed the standard pattern. More than a year before the meeting, all National Committees for Mathematics were informed that the General Assembly would elect a new Executive Committee of the Union, the Executive Committee of the International Commission on Mathematical Instruction, and the Commission on Development and Exchange. The National Committees were requested to send their proposals for candidates to the Secretariat by 31 December 1985 [355].

As a second step, all National Adhering Organizations were reminded that each of them shall appoint and certify to the Secretary of the Union a delegation which shall have the number of votes corresponding to the Group in which it adheres. If the NAOs wished to propose business to be transacted at the General Assembly, such proposals should reach the Secretary at least four months before the meeting [356].

The "Report of the Executive Committee to the tenth General Assembly," covering the period from 1 July 1982 to 30 June 1986, was distributed to the delegates before the meeting. The Union had fifty-two members on 1 January 1986, one more (Malaysia) than at the time of the 1982 General Assembly. It had supported fifteen congresses, conferences, seminars, or training courses. These included the Warsaw ICM and the Fifth International Congress of Mathematical Education, held in Adelaide, Australia, in 1984. In addition, ICSU had supported two conferences of ICMI and two of the CDE [357].

The tenth General Assembly of the IMU was held in Oakland, California, USA, 31 July–1 August 1986. The delegates were accommodated at the Airport Hilton, where the meetings also took place. In declaring the General Assembly opened, President Moser could state that the IMU was now firmly established. Its usefulness and importance had increased over the years, and the rules had become firmer and more definite.

In giving an account of the work of the IMU, Moser began by speaking of the international conferences and symposia sponsored by the Union. "These include meetings in a wide variety of fields and many different countries. From my own experience I can speak about the International Conference in Moscow and Leningrad (on contemporary problems of algebra and analysis) and express how fruitful this exchange has been for all participants. The initiative for these meetings lies with the local organizers. In my opinion

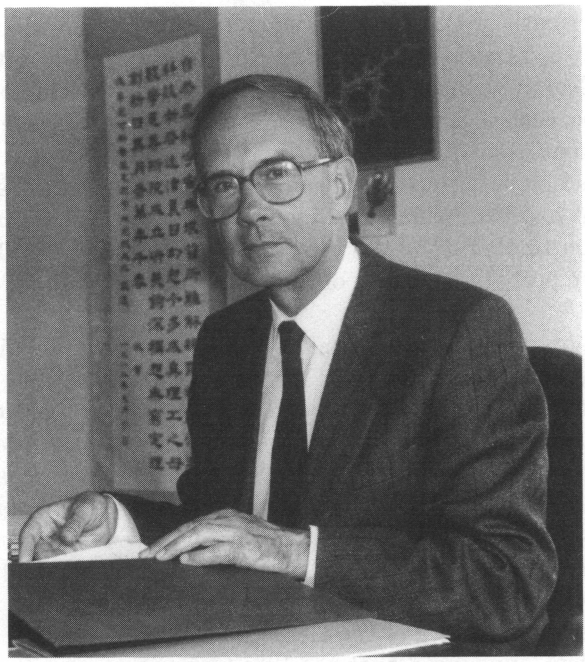

FIGURE 12.1. Friedrich Hirzebruch (born 1927). German mathematician (algebraic geometry, topology). Member of the Executive Committee of IMU 1963–1966. Member of the Consultative Committee for the Vancouver Congress 1974. Chairman of the Program Committee for the Berkeley Congress 1986. Member of the Fields Medal Committee for the Nice Congress 1970. Chairman of the Exchange Commission 1966–1978.

such international conferences play an important role in this world of fast developing mathematics."

Moser then told the General Assembly that the Program Committee for the ICM-1986 had been chaired by F. Hirzebruch (Fig. 12.1) and the Nevanlinna Prize Committee by L. Faddeev. As President of the IMU, Moser himself was the Chairman of the Fields Medal Committee.

In speaking about the interaction between mathematics and related fields, Moser said, in addition to what was quoted in Section 11.6, "The Union has already taken some steps in this direction. In its program of invited lecturers, this Congress covers a wide spectrum of mathematics including several neighboring fields. In the last two years this Union has made contact with COSPAR, an international space organization, affiliated with ICSU. Professor Lions, former Secretary of IMU, is participating in their congress in France. Finally, I want to mention the Rolf Nevanlinna Prize, awarded for the first time at the Warsaw Congress, which is intended for the purpose of encouraging research in information sciences."

In the aftermath of the Warsaw Congress, Moser concluded his speech as follows: "It is a crucial aspect of the Congress that it is of non-political character. Clearly, we are all affected strongly by political concerns, but they must be vented through other channels, while we have to restrict ourselves to mathematics."

The transaction of business went smoothly. No traces could be seen of the problems that had lain behind two important decisions, the membership of China (Section 10.6) and the election of the President (Section 10.5). Many delegates were probably unaware of the difficulties that had preceded these steps.

In connection with the membership of China, it was unanimously decided to delete the word "national" from the IMU Statutes. China was admitted to the Union in Group V with the adhering organization formed by two societies, the Chinese Mathematical Society and the Mathematical Society located in Taipei, China. The decision meant the cessation of the membership of China–Taiwan. The Assembly expressed its appreciation to China–Taiwan for showing such a spirit of cooperation and goodwill that had led finally to the successful conclusion of negotiations. The ease and speed with which this item of business was transacted were in striking contrast to the long history of the China issue.

The President announced that the Site Committee was recommending Kyoto as the site for the 1990 International Congress of Mathematicians. Since there were several candidates, discussion followed, but eventually the Assembly accepted Kyoto by acclamation. More will be said about this decision in Section 12.3.

The budget for the years 1987–1990 was accepted in the form the Executive Committee had recommended. The unit contribution was raised from 850 to 1,000 Swiss francs. The authorized annual expenditure was 208,300 Swiss francs, on the customary understanding that transfers were permitted from one item to another, and from one year to another, provided that no appropriation from Schedule B (scientific activities) was allowed to augment the provision made in Schedule A (administration). As mentioned in Section 11.2, the position of ICMI was essentially strengthened, and the same was true of the CDE. The IMU Executive Committee was granted an average annual sum of 51,000 Swiss francs for Symposia, Conferences, and Union Lectures. More money would probably be available, since savings from Schedule A could be expected, and they could be used for scientific purposes.

The General Assembly elected unanimously the following Executive Committee of the IMU for the period of four years starting 1 January 1987:

President: Ludwig Faddeev (USSR) (Fig. 12.2)

Vice-Presidents: Walter Feit (USA), Lars Hörmander (Sweden)

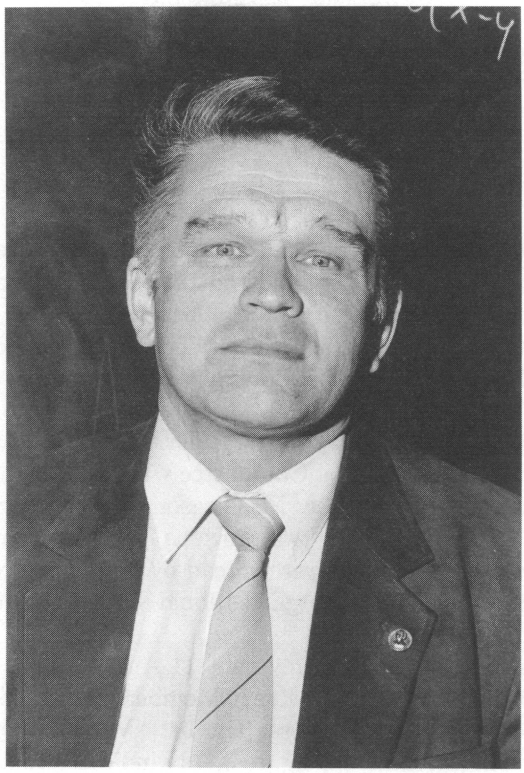

FIGURE 12.2. Ludwig Dmitrievich Faddeev (born 1934). Russian mathematician (mathematical physics). Vice-President of the IMU 1983–1986, President 1987–1990. Member of the Consultative Committee for the Warsaw Congress 1983. Chairman of the Rolf Nevanlinna Prize Committee for the Berkeley Congress 1986. Chairman ex officio of the Fields Medal Committee for the Kyoto Congress 1990.

Secretary: Olli Lehto (Finland)

Members: John Coates (U.K.), Hikosaburo Komatsu (Japan), László Lovász (Hungary), Jacob Palis Jr. (Brazil), C.S. Seshadri (India)

Past President Jürgen Moser (Switzerland) would be a member ex officio.

For ICMI, President Jean-Pierre Kahane (France) and Secretary A.G. Howson (U.K.) were both reelected. M.S. Narasimhan (India) was elected as the new Chairman of CDE. (For complete lists, see the Appendix, Sections 6 and 7.)

On the proposal of Mary Ellen Rudin, head of the U.S. delegates, the Assembly recommended to the newly elected IMU Executive Committee that subfields of mathematics, women mathematicians, and mathematicians from small countries should not be overlooked in the process of se-

lecting members of the Committees and Commissions of the IMU or as speakers to the ICM [358].

12.2 ICM-1986 at Berkeley

After the IMU General Assembly had accepted the invitation of the U.S. National Academy of Sciences to hold the 1986 International Congress of Mathematicians at the University of California, Berkeley, the Academy asked the American Mathematical Society to handle the organizational aspects of the Congress. The Society organized the Congress as a nonprofit corporation, ICM-86, with Dr. Jill P. Mesirov as Executive Director; the ICM-86, in turn, used the services of the American Mathematical Society's Meetings Department. A Steering Committee was appointed to oversee the arrangements. Chaired by Andrew M. Gleason, it had a large number of subcommittees. Compared to the two previous ICMs, 1978 in Helsinki and 1983 in Warsaw, responsibilities were spread over many more committees, and a professional touch to the organizational work was provided by the AMS Meetings Department.

The Congress was held at Berkeley on 3–11 August 1986. The Congress Proceedings mention that 3,586 Ordinary Members and 340 Accompanying Members registered for the Congress. The list "Membership by country" (which gives the slightly different figure 3,711) indicates that the Congress was very American, with 2,324 participants from the United States, as compared to 1,387 from the rest of the world. Again, the representation from the USSR, at 57, was disappointingly low.

All sessions took place on the campus of the University of California, Berkeley. The sixteen plenary sessions were simultaneously broadcast over closed-circuit television to several large lecture halls. There were 148 invited lectures in 19 sections, about 700 ten-minute short communications, and a large number of informal seminars arranged by participating mathematicians.

The opening session was held outdoors, in the Greek Amphitheater of the University—the pleasant California weather could be relied upon. At his opening address, Jürgen Moser, the President of the IMU, reminded those present that this Congress was still guided by the same principles as the first ICM in 1897: to foster personal relationships between mathematicians from different countries and to present a survey of the present state of mathematics. His analysis of the necessity for ICMs was similar to what Felix Klein had presented in 1893 (Section 1.1) and Hilbert in 1900 (Section 1.3): "At a time of increasing specialization and of proliferation of mathematics into many subfields, these Congresses play a particularly important role in bringing together mathematicians of different interests and backgrounds. The danger of fragmentation of our science into many sepa-

rate branches cannot be overemphasized. It is our hope that this Congress will help to counter this divisive tendency and give us a wide perspective of mathematics." Moser concluded his address by proposing that the Chairman of the Steering Committee, Andrew Gleason, from Harvard University, be elected President of the Berkeley Congress 1986.

Gleason called attention in his presidential speech to the utilitarian aspect of mathematics:

> Mathematics has always been useful. Many of the oldest written records of human civilization are accounting documents, and in fact today accounting still is the largest application of mathematics. But we are rapidly moving into a period in which more and more applications of mathematics are being found. New mathematical questions are being asked by scientists, engineers, and managers—often questions of an entirely different sort from those previously considered. New mathematical answers are being found often involving ideas previously thought to be entirely abstract and utterly nonutilitarian. As mathematicians we can justly be proud that the concepts we have worked so hard to develop are helping people to understand the real world just as they have helped us to understand our platonic world. There is a lesson in this, I think, and it is that as we enter this new era dominated by the computers, we should not fall into the trap of utilitarianism, but remember that the greatest progress in mathematics is always made by trying to understand the fundamental structures that underlie the subject rather than attempting to solve purely utilitarian problems.

The next speaker, Mary Ellen Rudin, Chairman of the U.S. National Committee for Mathematics, recalled that exactly fifty years ago, at the Congress held in Oslo, Norway, the first Fields Medals were awarded. "The two 1936 Medals went to Jesse Douglas, who is no longer living, and to Lars Ahlfors, who was then a young man not yet thirty years of age. In special celebration of the fiftieth anniversary of the Fields Medal and of Professor Ahlfors's fifty years of continued contributions to mathematics, I would like to nominate Professor Lars Ahlfors to be Honorary President of the Congress." Ahlfors was elected by acclamation. His reminiscences of the Oslo Congress were presented in Section 3.4 [359].

A message from President Ronald Reagan to the Congress was read in the session. Faddeev, Chairman of the Nevanlinna Prize Committee, then announced the award of the 1986 Nevanlinna Prize to Leslie Valiant, Harvard University, USA. Moser, as Chairman of the Fields Medal Committee, reported that the names of the Fields Medalists for 1986 were Simon Donaldson (U.K.), Gerd Faltings (Federal Republic of Germany) and Michael Freedman (USA). The winners received their medals and prizes from Honorary President Ahlfors.

Donaldson's work was presented by Michael Atiyah: "In 1982, when he was a second-year graduate student, Simon Donaldson proved a result that stunned the mathematical world. Together with the important work of Michael Freedman, Donaldson's result implied that there are "exotic" 4-spaces, i.e., 4-dimensional differentiable manifolds which are topologically but not differentiably equivalent to the standard Euclidean 4-space $\mathbf{R}^4$. What makes this result so surprising is that $n = 4$ is the only value for which such exotic n-spaces exist."

Barry Mazur said of the work of Faltings, "One of the great moments in mathematics was when Gerd Faltings revealed the circle of ideas which led him to the proof of the conjecture of Mordell. This conjecture... had stood as a goad and an elusive temptation for over half a century."

Freedman's work was presented by John Milnor: "Michael Freedman has not only proved the Poincaré hypothesis for 4-dimensional topological manifolds, thus characterizing the sphere $\mathbf{S}^4$, but has also given us classification theorems, easy to state and to use but difficult to prove, for much more general 4-manifolds. The simple nature of his results in the topological case must be contrasted with the extreme complications which are now known to occur in the study of differentiable and piecewise linear 4-manifolds."

V. Strassen opened his presentation of Valiant's work as follows: "Theoretical computer science is very young, when compared for instance to number theory, geometry, or topology. While these classical fields are like magnificent old oaks, whose growth takes place at dizzying heights and is therefore not easy to follow, theoretical computer science resembles a fast-growing young tree, whose fresh green may be perceived and enjoyed by everyone coming near. Leslie G. Valiant has contributed in a decisive way to the growth of almost every branch of this young tree [360]."

The aftermath of the Warsaw Congress was felt at Berkeley. As is customary at the ICMs, an exhibition of mathematical books was arranged on the Congress premises. On display was the book *International Mathematical Congresses, an Illustrated History 1893–1986*, which had just appeared. Olech felt that the 1983 Warsaw Congress was not correctly represented, and the President and Secretary of the IMU concurred. The publisher, Springer-Verlag, withdrew the copies from circulation and produced a revised edition, in which the ICM-86 could also be included [361].

At the final session of the Congress, President Moser greeted Marshall Stone, the first President of the new IMU: "It was Professor Stone who played a decisive role in reestablishing the IMU in 1950 after it ceased to exist in 1932."

The large participation of mathematicians from the USSR at the Warsaw Congress had proved to be a passing episode. In his address Moser said,

> It was a great disappointment for all of us that many of the invited speakers from the Soviet Union did not come to Berkeley; in fact, almost half of the Soviet speakers were not present.

> This is a serious loss for everybody concerned and defeats the purpose of the Congress. It is most important for any Congress that the invited speakers are able to attend in order to deliver their lectures in person and to take part in the exchange of ideas. We are aware that our Soviet colleagues worked very hard at resolving this problem, and we appreciate their efforts. Also, most of the manuscripts of the absent speakers were made available and could be presented by other mathematicians. Regardless of circumstances, it is always a disappointment if invited speakers from any country are unable to attend, and let me express our hope that at the Congress 1990 all invited speakers from all countries will be present.
>
> As you may know, the IMU is a member of the International Council of Scientific Unions (ICSU) and as such is committed to the ICSU principle of free circulation of scientists. I am happy to report that to the best of my knowledge the host country has granted all visas which have been applied for. In some difficult cases the help from ICSU was indeed essential. [Moser must have meant the Cuban mathematicians, who had experienced problems in obtaining their visas.] This again demonstrates the importance of the ICSU principle for our Union. Let me add that two weeks ago at the General Assembly of the IMU a resolution was adopted reaffirming an ICSU article on nondiscrimination.

After reporting on the decisions taken at the General Assembly and making some personal remarks as the outgoing President, Moser yielded the floor to M. Nagata, who spoke on behalf of the Japanese Committee for Mathematics: "I have the honor of inviting you to the next International Congress of Mathematicians in Kyoto. Kyoto had been the capital of Japan for about one thousand years and can show you some of the old Japanese culture. We are quite aware that it must be a difficult task to organize such a big meeting. However, taking into account the help of the International Mathematical Union and also the cooperation of the mathematical community of the world, I believe that we will be able to overcome the difficulties."

President Gleason's concluding words, before he declared the Congress closed, were as follows:

> This Congress is part of a long tradition of internationalism. At least since the days of Archimedes, mathematicians have corresponded with one another and travelled great distances to study, teach, and confer. As the expense of printing and travelling has declined, the tradition has strengthened. Now hundreds of mathematical books and journals are published every year. These pass freely over international boundaries and propagate

> new mathematical ideas throughout the world. Mathematicians travel ever more frequently from one university or institute to another. As we think of this Congress, let us resolve to maintain and expand our great tradition of freedom to study, travel, and confer so that the Kyoto Congress will be even more truly international [360].

12.3 Japan Hosts the 1990 General Assembly

For a long time, there had been discussions about Japan hosting an ICM. When the question came up for the first time in the 1960s, the timing was still premature. But right after the 1978 Congress in Helsinki, where the decision had been taken to hold the next ICM in Warsaw, the Japanese option for the ICM-1986 was a serious one. During my visit to Japan in summer 1979, investigations into possible sites of the Congress were dealt with at a detailed level. How to avoid the drawbacks of unfavorable climatic conditions was repeatedly discussed. The month of August was the time-honored optimal month in which to hold the Congress. But in August most of Japan would be very hot. An exception would be the northern island Hokkaido, but there, in Sapporo, mathematicians willing to take care of local arrangements could not be found. Tokyo and Kyoto were the two favored sites, but university premises there were not air-conditioned.

Although a clear-cut decision did not emerge, I was surprised to hear in 1981 that the Japanese had abandoned the idea of organizing the ICM-1986. The Americans then came to the rescue with an invitation to hold the Congress at Berkeley. President Carleson and Secretary Lions must have considered it self-evident that the uncontested American invitation should be accepted. Members of the Site Committee were more or less told about the fait accompli; they confirmed the decision in 1982.

Soon after the Warsaw Congress, the Japanese expressed their interest in inviting mathematicians of the world to the ICM-1990. Later, Kyoto was chosen as the site. The Congress would be held there in August at the fully air-conditioned Kyoto International Conference Hall [362]. It should have been an easy matter for the Site Committee to accept the Japanese invitation. However, there was a formidable competitor. The German Mathematical Society had issued an invitation to hold the ICM-1990 in Munich. At an early stage it became clear that comprehensive preparations, carried out with German thoroughness and strongly backed by the University and the City of Munich, were already well advanced [363].

It would not be easy to reject the German bid. For a while, the Site Committee, which was identical with the Executive Committee, except that Gleason replaced Mizohata, could not make up its mind. It was felt, however, that a good opportunity having arisen, the IMU should widen

its circle and hold the ICM outside Europe and North America. Moreover, after the Japanese had refrained from the organization of the ICM-1986, they had been unofficially requested to host the ICM-1990 instead. This was felt to be morally binding, at least to some extent. The Soviet member of the Site Committee took a clear stand in favor of Japan, explaining that thanks to inexpensive Aeroflot flights, distance would not essentially reduce participation from Socialist countries to a Congress in Japan. (In fact, the USSR did have relatively good participation in Kyoto.) Between the two good alternatives, the Site Committee chose Japan.

The story has an epilogue. After making the decision in favor of Japan, the Site Committee decided "to encourage Germany to consider an invitation to hold the Congress in 1994" [364]. Germany could be assured of the unanimous support of the Executive Committee, with which the Site Committee would be almost identical. The Germans refused, explaining that all their plans had aimed towards Munich in 1990 and that they had no desire to start all preparations again from zero. Repeated attempts to persuade the Germans were unsuccessful. The Site Committee then decided to accept the Swiss invitation to hold the 1994 ICM in Zurich. Soon after that decision had been made, in 1989, profound political changes began to take place in Europe. The Berlin wall came down, reunification of Germany was foreseeable. In the new situation, the Germans proposed that the ICM-1994 be held in Berlin. The bid came too late and could not be accepted. But the next Site Committee recommended that the ICM-1998 should be held in Berlin, and this was confirmed by the 1994 IMU General Assembly.

After Japan had been chosen to host the 1990 Congress, the Japanese organizers decided to arrange the meeting of the General Assembly of the IMU in Kobe, 18–19 August 1990. The Union had fifty-two members, which was the same number as at the opening of the previous General Assembly. A look at the membership figures of the years 1932, 1952, and 1990, which are presented in the table below, shows that the relative representation of Europe has steadily decreased, while Asia has exhibited a conspicuous rise.

	1932		1952		1990	
	no.	%	no.	%	no.	%
Europe	16	(70)	14	(64)	26	(50)
Asia	1	(4)	2	(9)	12	(23)
North and South America	3	(13)	5	(23)	7	(13)
Africa	2	(9)	0	(0)	5	(10)
Australia and Oceania	1	(4)	1	(5)	2	(4)

(Cf. the lists in the Appendix, Section 1.) Of course, the membership figures alone do not reflect the mathematical activity of the various continents. If measured in terms of the names in the *World Directory of Mathematicians* or of invited speakers at the ICMs, the relative weight of the United States alone would be almost forty percent.

A visible demonstration of the expanded activities of the Union was the fact that it sponsored twenty-five scientific meetings during the four-year period beginning 1 July 1986; a far cry from the modest beginnings in the early 1950s. Foremost among them was the 1986 International Congress of Mathematicians at Berkeley, described in the previous section. A large meeting was also the sixth International Congress on Mathematical Education, ICME 6, which was held in Budapest, Hungary, from 27 July to 3 August 1988. It was attended by more than two thousand participants from seventy-four countries.

A conference in which the Executive Committee of the IMU was directly involved was "A Special Event in Honor of Professor K. Chandrasekharan," organized in Paris on 20 April 1989. Various aspects of Chandrasekharan's work were described by J. Moser, L. Schwartz, O. Lehto, H. Cartan, A. Selberg, and R. Narasimhan.

Mathematical events not recorded in the "Report" took place at the time of the fifty-first and fifty-second meetings of the Executive Committee, held in 1987 at the Steklov Institute, in Leningrad, and in 1988 at the Instituto de Matemática Pura e Aplicada (IMPA), in Rio de Janeiro. Faddeev stated that if the Executive Committee meeting in Leningrad could be combined with a mathematical seminar with the members of the Executive Committee as speakers, all local expenses of the Executive Committee would be underwritten by the Steklov Institute. A year later, Palis proposed that the meeting of the Executive Committee be held in Rio, at IMPA. Having been told that this was not feasible because of excessive travel costs, Palis went even further than had Faddeev: If a seminar could be held, IMPA would cover a good part of all expenses. Both seminars took place. Thereafter, such arrangements have been repeated whenever possible. Adding mathematics to administrative meetings was well in line with the general ideology of the IMU.

In addition to the reports of ICMI and CDE, there was, for the first time, also a report of ICHM (International Commission on the History of Mathematics) by Chairman J.W. Dauben. In his comprehensive account, Dauben pointed out that "the XVIIIth International Congress of History of Science, which was held in Hamburg/Munich, August 1–9, 1989, was the first opportunity that the International Commission on the History of Mathematics has had to meet at an International Congress since becoming a joint Commission of the IMU and IUHPS two years ago."

Two series of Union Lectures were delivered during the four-year period. Enrico Bombieri (Princeton) lectured on "Questions of effectivity in number theory" at the ETH in Zurich, Switzerland, in June 1986. In November and December 1988, V.I. Arnol'd (Moscow) presented a series of lectures, "Contact geometry and wave propagation," at the University of Oxford, England (cf. Section 10.5 [365].

The meeting of the eleventh General Assembly of the IMU (Fig. 12.3), in Kobe, Japan, was held in the new International Convention Center on an is-

FIGURE 12.3. IMU General Assembly 1990. A seating arrangement that has become standard. The Executive Committee in the back, from the left: Lovász, Komatsu, Moser, Lehto, Faddeev, Palis, Feit, Coates, Seshadri. The delegates are seated in the alphabetical order of their countries.

land in front of the city. The new political climate could be sensed. Faddeev concluded his presidential address with the following words: "It is traditional... to reiterate our commitment to the principle of free circulation of scientists. The political issues in connection with this were sometimes a source of tension. Now due to changes in many countries this topic became self-evident, as it must be. This makes it possible for us to concentrate on our main professional duty—mathematics."

The changing world was also visible on the agenda. One of the items was the application of Georgia to become a member of the IMU. Since the USSR was still in existence, this could have become a difficult question to handle. The General Assembly refrained from taking a stand and asked the new Executive Committee to study the application. Political developments solved the problem. After the disintegration of the Soviet Union in 1991, it was easy to recommend that Georgia be admitted to the Union. Later, the IMU accepted other countries of the former Soviet Union to membership. On the other hand, as a result of the reunification of Germany, the German Democratic Republic announced at the end of 1990 that its membership in the IMU had ceased.

As a foretaste of the developments in the 1990s, there was lively discussion of the role of applied mathematics and its balance in the program of the ICM, and of the increasing relevance of mathematics in industry.

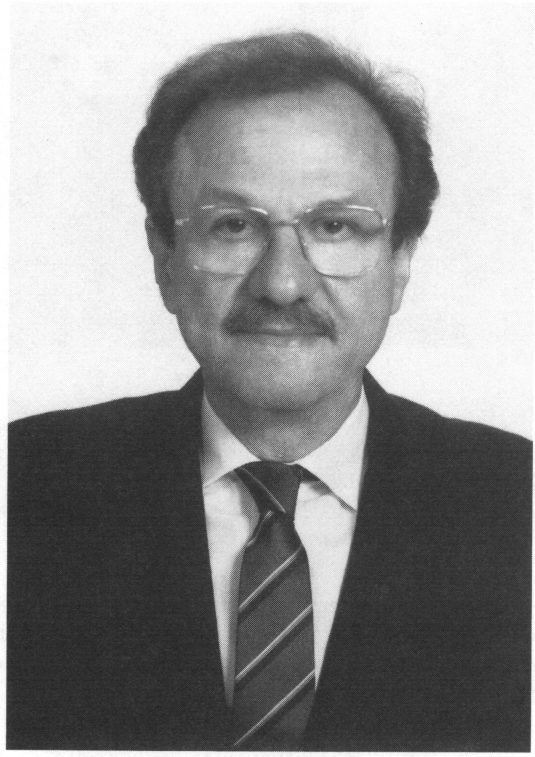

FIGURE 12.4. Jacob Palis Jr. (born 1940). Brazilian mathematician (dynamical systems). Member of the Executive Committee of the IMU 1983–, Secretary 1991–. Chairman of the Committee for the World Mathematical Year 2000.

The Nominating Committee did not receive any names from the floor. The IMU Executive Committee elected for the four years 1991–1994 was as follows:

President: J.-L. Lions (France)

Vice- Presidents: J. Coates (U.K.), D. Mumford (USA)

Secretary: J. Palis (Brazil)

Members: J. Arthur (Canada), A. Dold (Germany), H. Komatsu (Japan), L. Lovász (Hungary), E. Zehnder (Switzerland)

Past President L. Faddeev was a member ex officio.

With the election of Palis as Secretary (Fig. 12.4), the domicile of the IMU moved to Rio de Janeiro, the secretariat being located at Instituto de Matemática Pura e Aplicada. In the 1960s, the domicile had been for a few years in Bombay, but otherwise always in Europe.

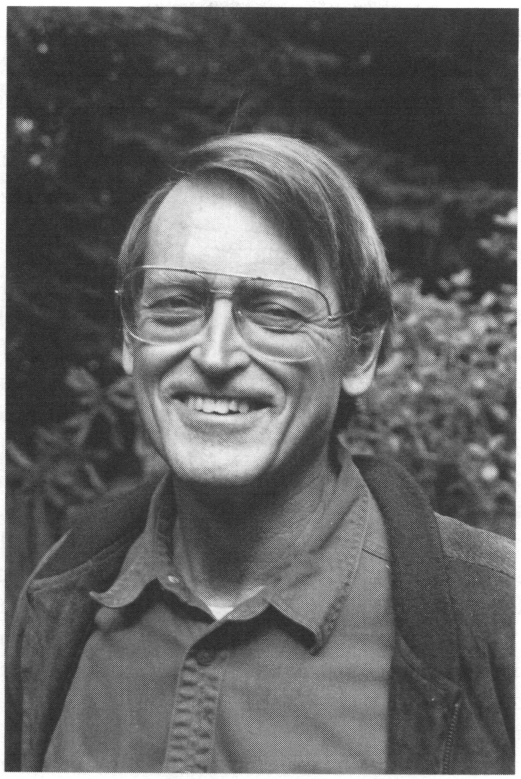

FIGURE 12.5. David Mumford (born 1937). American mathematician (algebraic geometry, pattern recognition). Vice-President of the IMU 1991–1994. Elected President for the period 1995–1998. Member of the Fields Medal Committee for the Warsaw Congress 1983 and Chairman for the Zurich Congress 1994. Fields Medalist 1974.

Having been told that the Executive Committee was considering him as the next IMU President, Lions first declined to run. When pressed, he revealed the reason: His son might be a candidate for the 1994 Fields Medal. After the Executive Committee promised to release him from the Fields Medal Committee and appoint a Vice-President to chair it, Lions gave his consent. (His son Pierre-Louis Lions did receive the Fields Medal in 1994, by the decision of the Committee chaired by Vice-President Mumford (Fig. 12.5).)

The U.S. Committee for Mathematics had proposed that Karen Uhlenbeck be a candidate to the Executive Committee of the Union. When the old Executive Committee prepared its slate, this American proposal found sympathy. However, Uhlenbeck was ultimately replaced by David Mumford, who had unusually great merits in both pure and applied mathematics. The decision was not unanimous. It was felt that the election of a woman was

long overdue and that the nomination of Uhlenbeck would have provided a good opportunity to change the tradition, in spite of the excellent names on the slate. As it was, the IMU Executive Committee kept its "men only" status.

For ICMI, Miguel de Guzmán (Spain) was elected President and Mogens Niss (Denmark) Secretary. M.S. Narasimhan was reelected Chairman of the CDE.

The President announced that the Site Committee had recommended Zurich as the site for the 1994 International Congress of Mathematicians. Some delegates demanded to know the reasons why the alternative sites had been rejected. Such a discussion, carried out in front of the whole Assembly, can easily become very delicate. Finally, Zurich was accepted by the Assembly by majority vote. As more openness in the decision making was required, the next Executive Committee was assigned the task of formulating the rules for the Site Committee and distributing its proposal to the members in 1991.

The following Resolution was accepted: "Whereas the IMU wishes to mark the turn of the century in a manner appropriate to the standard set by David Hilbert in 1900, the General Assembly directs the Executive Committee to set up a committee to report to the adhering bodies by September 1991 how to accomplish this so that in 1994 the Assembly can discuss it and decide how to proceed." A brief return to this topic will be made in Section 12.5.

The General Assembly recorded its satisfaction that more women than ever before had been invited to speak at ICM-1990 and expressed the wish that this trend should continue in the future [366].

12.4 ICM-1990 in Kyoto

Preliminary arrangements for the Kyoto Congress were in the hands of the "Committee of ICM-90," which the Mathematical Society of Japan had set up in December 1986. In August 1989, a large Organizing Committee was established, with a great number of subcommittees. The large-scale participation of Japanese mathematicians was a striking feature of the arrangements. Among the many hard-working organizers, an exceptionally heavy burden was carried by the Secretary General of the Organizing Committee, Huzihiro Araki, from Kyoto University.

The Program Committee was appointed at the meeting of the Executive Committee in Leningrad in May 1987, with Nicolas Kuiper (Fig. 12.6) as Chairman. The process that was to lead to the dissolution of the Soviet Union had started. As a sign of the increasing liberalism, the Soviets had proposed that V.I. Arnol'd be elected to the Committee. As related above

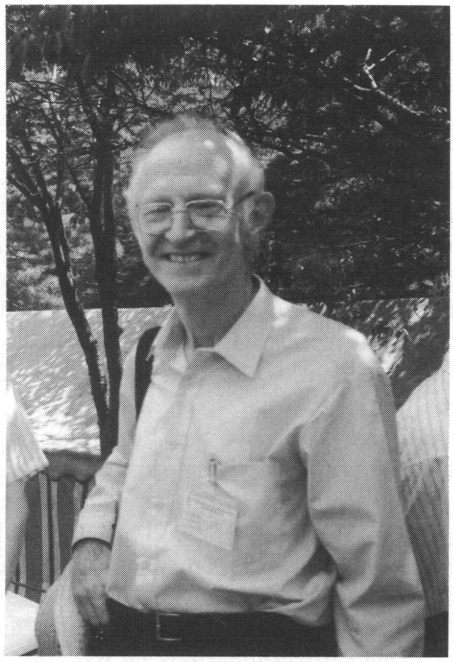

FIGURE 12.6. Nicolas Kuiper (1920–1994). Dutch geometer. Member of the Executive Committee of the IMU 1971–1974. Member of the Consultative Committee for the Nice Congress 1970. Chairman of the Program Committee for the Kyoto Congress 1990.

(Section 10.5), the Jewish Arnol'd had earlier been denied permission to leave the USSR in order to present the Union Lectures at Oxford University.

There was an unexpected deviation from the rule that the invited speakers are chosen by the Program Committee, except possibly for a few speakers from the country of the Congress. To the twelve Japanese speakers invited on the advice of the Program Committee, the Japanese Organizing Committee added another twelve. Moreover, the Organizing Committee invited three Soviet speakers not on the Program Committee's list. These additions were made without consulting the Program Committee. The Secretary of the IMU asked Kuiper whether the number of speakers from some countries was biased in an undesirable way. Kuiper replied in the negative in a written reply: "I was in favor of the Japanese using their host right to nominate some Japanese speakers on their own initiative.... I am convinced that the level of all invited speakers is worthy of the IMU." Kuiper also expressed understanding for adding speakers from the USSR, because "the study and appreciation of Soviet mathematicians has been hampered as for former congresses by a possible lack of information and contact" [367].

The shift towards applied mathematics that had been going on in the 1980s could be seen from the selection of invited speakers. The number of sections that could be regarded as "applied" or close to applied rose from less than forty percent at the ICM-1978 to almost fifty percent at the Kyoto Congress.

The Congress took place on 21–29 August 1990. All sessions were held in the Kyoto International Conference Hall. At the opening of the Congress Faddeev pointed out that "this is the first Congress in the history of the International Mathematical Union to take place outside of Europe and North America. This is consonant with the main goal of the Union—the promotion of mathematical research throughout the world."

Following Faddeev's proposal, H. Komatsu was elected President of the Congress. In his presidential address, Komatsu called attention to the favorable external conditions: "We have benefited very much by the recent reconciliation of the world politics and the prosperity of the Japanese economy." The budget of the Congress, Komatsu said, amounted to approximately 300 million yen (approximately $2 million). One-third of the revenue was from registration fees, one-third from donations from private companies. The remaining third consisted of subventions from the IMU, the Japan Research Council, the Mathematical Society of Japan, and—what was by far the largest part of this third—donations by individual members of the Mathematical Society of Japan. Komatsu regretted the high registration fee of 30,000 yen. This was forced by Japanese tax regulations, which did not allow the receipt of tax-exempt donations exceeding the amount of registration fees.

In speaking about the finances, Komatsu could reveal a positive feature of the Kyoto Congress. Aside from the budget, the Japanese had been able to allocate sixty million yen to assist foreign participants. In all, 269 participants, mostly young mathematicians from developing countries or from countries with currency restrictions, could be supported. This number included 47 IMU grantees. Komatsu continued:

> Today, 4,000 mathematicians from eighty-three countries have assembled here to review our scientific achievements over the last few years and to set goals for the future in all fields of mathematics ranging from pure mathematics through applied mathematics to mathematical education. This seems to be an almost megalomaniac dream at this time of specialization. I do not know of any other discipline which attempts to hold this kind of congress regularly. I have often wondered why mathematicians do have Congresses and what Congresses mean to them. My answer is that Congresses are to mathematicians what Bon and the New Year Festivities are to Japanese, in which they abandon their daily life completely.

The official Congress statistics listed 4,102 ordinary members. Among the participants, as many as 2,409 were Japanese. The other national contingents were much smaller: USA 396, France 123, USSR 110, the others fewer than 100 each. In fact, the Congress was attended by only around 3,950 ordinary members. All the preregistered members from seven countries were unable to attend because of the crisis in the Persian Gulf, which had begun a few weeks before the start of the Congress.

After Komatsu's address, Kiyosi Ito, the eminent probabilist who had been instrumental in the organization of the Congress, was elected Honorary President. Among the many speakers, the President of Kyoto University, Yasunori Nishijima, himself a physicist, crystallized the idea of the ICMs by quoting David Hilbert: "Mathematics is an organism for whose vital strength the indissoluble union of the parts is a necessary condition."

The opening session was concluded by the announcement of the winners of the prizes of the IMU. Faddeev, as Chairman of the Fields Medal Committee, said that after thorough consideration of the material at the Committee's disposal, the decision had been made to award four Medals—to Vladimir G. Drinfeld (USSR), Vaughan F.R. Jones (New Zealand), Shigefumi Mori (Japan), and Edward Witten (USA). László Lovász, Chairman of the Rolf Nevanlinna Prize Committee, announced that the Prize was to be awarded to Alexander A. Razborov, from Moscow. The winners received their medals and prize checks from Mr. Kosuke Hori, Minister of Education, Science, and Culture.

After the opening ceremonies, the work of the prizewinners was presented. Yuri I. Manin, who had been invited to speak about the work of Drinfeld, was not present, but his text was read. Manin concentrated upon the two subjects that were Drinfeld's main preoccupation in the previous decade: Langlands's program (a series of conjectures, theorems, and insights aimed at an understanding of the Galois groups of dimension one) and quantum groups. In both domains, Drinfeld's work constituted a decisive breakthrough and had prompted a wealth of research.

Joan S. Birman spoke about the work of Jones. In 1984 Jones discovered an astonishing relationship between von Neumann algebras and geometric topology. He found a new polynomial invariant for knots and links in 3-space. As time went on, it became clear that his discovery had to do in a bewildering variety of ways with widely separated areas of mathematics and physics.

Heisuke Hironaka, in speaking about the work of Mori, pointed out that the most profound and exciting development in algebraic geometry during the last decade or so was the Minimal Model program, or Mori's program, in connection with the classification problems of algebraic varieties of dimension three. Mori's theorems on algebraic threefolds were stunning and beautiful in their totally new features, unimaginable by those who had been working in the traditional world of algebraic or complex analytic surfaces.

Faddeev had asked Michael Atiyah to speak about the work of Witten. Atiyah could not come to Kyoto but was ready to prepare a written address. So it was decided that Faddeev would present Atiyah's address, adding his own comments. Atiyah called attention to the remarkable renaissance in the interaction between mathematics and physics. The mathematical community had benefited from this interaction in two ways. First, mathematicians had been spurred into learning some of the relevant physics and collaborating with colleagues in theoretical physics. Second, and more surprisingly, many of the ideas emanating from physics had led to significant new insights into purely mathematical problems, and remarkable discoveries had been made in consequence. "In all this large and exciting field, Edward Witten stands out clearly as the most influential and dominating figure. Although he is definitely a physicist, his command of mathematics is rivalled by few mathematicians. Time and again he has surprised the mathematical community by a brilliant application of physical insight leading to new and deep mathematical theorems."

The work of A.A. Razborov was presented by the Chairman of the Rolf Nevanlinna Prize Committee, László Lovász. He said that perhaps the most difficult and deepest field in computer science is the derivation of lower bounds for the computational complexity of various problems. In an area where any step forward seemed almost hopeless, Razborov's results meant that deep methods could be developed and that to obtain strong lower bounds for algorithms was not impossible.

In Kyoto, the role of mathematical physics in the work of the Fields Medal winners was striking. The work of Drinfeld and Jones had strong connections with physics. The case of Witten was even more conspicuous, as he was a physicist himself. Atiyah felt it necessary to remark that although not all of Witten's results had been formulated in the way mathematicians expect, his insight so far had never let him down, and rigorous proofs had always been forthcoming.

Mathematical physics was not only visible in connection with the Fields Medals. President Faddeev could say in the closing ceremonies of the Congress, "I believe that we can judge very highly the results of the scientific program and congratulate the Program Committee on their success. Personally, I was glad to observe how prominently Mathematical Physics was represented in its connections with other domains of Mathematics."

In his closing address, Faddeev told the audience that the Emperor and Empress of Japan had invited the winners of the Fields Medals and the Nevanlinna Prize to visit them in Tokyo. In informing the audience of the results of the IMU General Assembly in Kobe, he announced that the next Congress would be held in Zurich, Switzerland. S.D. Chatterji invited the audience to the ICM-94 by recalling that the honor and responsibility of organizing the Congress had fallen on Zurich twice before in the past, in 1897 and 1932. "Situated in beautiful natural surroundings in the heart of Europe, Zurich is easily accessible by rail, road, and air."

Before declaring the Congress closed, Komatsu said:

> I felt that we are at another turning point of mathematics. The previous one was marked at the Second Congress in 1900 when Hilbert gave his famous lecture. Since then we have obtained an enormous number of general results by axiomatization and abstract formulation, often at the hands of mathematical giants. This time it is a transition from abstract simplification to more concrete synthesis. We are now in a fortunate time when we can solve many problems which remained open for many years in spite of all the efforts of past generations of mathematicians. We no longer have a single genius, but many people work together developing new strong streams. It was only many brooks last time at the Congress in Berkeley. They meet together, and now we see a big river or a sea or even an ocean [368].

12.5 World Mathematical Year 2000

As related in Section 12.3, the 1990 General Assembly in Kobe decided that the IMU should mark the turn of the century in a manner appropriate to the standard set by David Hilbert in 1900. For the preparations, the following committee was appointed [366]:

Chairman: J. Palis Jr. (Brazil)

Members: V.I. Arnol'd (Russia), F. Hirzebruch (Germany), L. Lóvász (Hungary), B. Mazur (USA), S. Mizohata (Japan), G.D. Mostow (USA), W. Thurston (USA), J. Tits (France), S. Varadhan (USA)

In May 1992 in Rio de Janeiro, during the celebration of the fortieth anniversary of the Institute of Pure and Applied Mathematics, IMPA, J.-L. Lions, President of the IMU, declared in the name of the Union that the year 2000 will be the World Mathematical Year. The WMY 2000 was launched under the sponsorship of UNESCO and several other organizations.

The Declaration of Rio de Janeiro set three aims. The first was entitled "The great challenges of the 21st century." It reiterated the resolution of the Kobe General Assembly to envision the great mathematical challenges of the year 2000. In 1900, a single mathematician, David Hilbert, had been able to present a vision that had enriched mathematical research throughout the twentieth century. Now a committee of eminent mathematicians was given the task of figuring out how to accomplish what Hilbert had done alone.

The second aim was "Mathematics, keys for development." Since pure and applied mathematics provide one of the main keys for the understanding of the world and of its development, countries that are members of

UNESCO should gradually be able to reach a level of mathematical activity that would make possible their admission to the IMU. This implies great additional efforts in the fields of education, training, and access to scientific information. The second aim represented a special challenge to the CDE and ICMI and, more generally, reconfirmed the global responsibility of the Union.

The third aim was entitled "The image of mathematics." Mathematics should be systematically present in the information society, "thanks to examples and applications which will be scientifically exact and open to the largest number." ICMI's President M. de Guzmán and Secretary M. Niss suggested emphasizing three ideas: The role of mathematics in culture and society, an overview of the impact of mathematics on technology (ancient, modern, and future), and a general effort to counteract inaccurate images of mathematics among the general public. In line with this aim was the French proposal to La Poste to issue four or six stamps for the year 2000 to illustrate the World Mathematical Year 2000. The hope was expressed that such an initiative could be taken in other countries all over the world. Thus the IMU ventured into a new area—to raise the visibility of mathematics in society at large [369].

As of this writing (early 1997), plans of the IMU for the year 2000 have not yet been completely settled. As a counterpart of Hilbert's grandiose program of 1900, a book will be published with articles by some thirty leading mathematicians on perspectives and open problems of mathematics at the turn of the century. In addition, a number of meetings will be sponsored around the world, including developing countries.

In the 1990s, the significance of research and higher education on economic development has become increasingly clear. The growing interest of society at large in science and its applications has once again led to a lively debate about the motives and justification of scientific research. What should be the balance between "pure" research, which arises from within science itself and poses new questions from the basis of previous knowledge, and "applied" research, whose challenges come from other disciplines or, more generally, from the needs of the society to which research is expected to respond?

There is, of course, no clear-cut boundary between pure and applied research, whose interrelation is inherent in most fields of science. In mathematics, demands from the outside world have increased in recent years as mathematical applications have continued to expand over vast areas of human knowledge. Applied mathematics is becoming an ever more powerful force, and the repercussions will be large and many. Yet, the IMU is the only worldwide organization with the task of promoting pure mathematics. The great challenge of the Union at the approach of the new millennium is to do its part in bringing basic research and applications into mutually beneficial interaction.

Appendix

1 Members of the IMU

By the Statutes of 1920, the members of the IMU are divided into five Groups: I, II, III, IV, V, such that the number of votes of a member country is equal to the number of the Group to which it belongs. Furthermore, each member country shall pay an annual subscription in accordance with the Group in which it adheres, such that in Groups I, II, and III, the number of unit contributions is 1, 2, and 3, respectively; in Group IV it is 5; and in Group V it is 8. Exactly the same stipulations were included in the statutes of 1950, and they remained in force until 1975. In 1920, the population of the country determined the Group, whereas in the new Union, the General Assembly determines the Group after the country itself has announced its wish.

20 September 1920: 11 countries (Europe 9, North and South America 1, Asia 1) Belgium, Czechoslovakia, France, Greece, Italy, Japan, Poland, Portugal, Serbia, United Kingdom, United States

11 September 1932: 23 countries (Europe 16, North and South America 3, Africa 2, Asia 1, Australia and Oceania 1) Australia, Belgium, Bulgaria, Canada, Czechoslovakia, Egypt, France, Greece, Hungary, Italy, Japan, Mexico, the Netherlands, Norway, Poland, Portugal, South Africa, Spain, Sweden, Switzerland, United Kingdom, United States, Yugoslavia

March 8, 1952: 22 countries (Europe 14, North and South America 5, Asia 2, Australia and Oceania 1)

Group I: Argentina, Australia, Austria, Cuba, Finland, Greece, Norway, Peru

Group II: Canada, Denmark, the Netherlands, Pakistan, Spain, Switzerland, Yugoslavia

Group III: Belgium

Group IV: France, Germany, Italy, Japan

Group V: U.K., USA

31 August 1954: 30 countries (Europe 17, North and South America 7, Asia 5, Australia and Oceania 1)

Group I: Argentina, Australia, Brazil, Cuba, Finland, Greece, Iceland, Malaya-Singapore, Mexico, Norway, Peru, Portugal

Group II: Austria, Canada, Denmark, Israel, the Netherlands, Pakistan, Spain, Sweden, Switzerland, Yugoslavia

Group III: Belgium, India

Group IV: France, Germany, Italy, Japan

Group V: U.K., USA

New: Brazil, Iceland, India, Israel, Malaya-Singapore, Mexico, Portugal, Sweden

11 August 1958: 36 countries (Europe 23, North and South America 7, Asia 5, Australia and Oceania 1)

Group I: Argentina, Australia, Brazil, Bulgaria, Cuba, Finland, Greece, Iceland, Malaya-Singapore, Mexico, Norway, Peru, Portugal

Group II: Austria, Denmark, Israel, Pakistan, Romania, Spain, Sweden, Yugoslavia

Group III: Belgium, Canada, Czechoslovakia, Hungary, India, the Netherlands, Switzerland

Group IV: France, Germany, Italy, Japan, Poland

Group V: U.K., USA, USSR

New: Bulgaria, Czechoslovakia, Hungary, Poland, Romania, USSR

11 August 1962: 37 countries (Europe 24, Asia 6, North and South America 6, Australia and Oceania 1). *New*: China–Taiwan, Eire, both to Group I; Finland moved from Group I to Group II; *Withdrawn*: Peru

13 August 1966: 41 countries (Europe 26, Asia 7, North and South America 6, Africa 1, Australia and Oceania 1)

Group I: Argentina, Australia, Brazil, Bulgaria, China–Taiwan, Cuba, East Germany, Eire, Greece, Iceland, Malaya-Singapore, Mexico, North Korea, Norway, Portugal, South Africa, Turkey

Group II: Austria, Denmark, Finland, Israel, Pakistan, Romania, Spain, Sweden, Yugoslavia

Group III: Belgium, Canada, Czechoslovakia, Hungary, India, the Netherlands, Switzerland

Group IV: France, Germany, Italy, Japan, Poland

Group V: U.K., USA, USSR

New: East Germany, North Korea, South Africa, Turkey

28 September 1970: 42 countries (Europe 26, Asia 7, North and South America 6, Australia and Oceania 2, Africa 1); *New*: New Zealand to Group I; Australia moved to Group II; the name of Germany was changed to Federal Republic of Germany, that of East Germany (which moved to Group III) to German Democratic Republic

1 January 1974: 42 countries (Europe 26, Asia 6, North and South America 6, Africa 2, Australia and Oceania 2)

Group I: Argentina, Brazil, China-Taiwan, Cuba, Greece, Iceland, Ireland, Mexico, New Zealand, Nigeria, North Korea, Norway, Portugal, South Africa, Turkey

Group II: Austria, Bulgaria, Denmark, Finland, Israel, Pakistan, Romania, Spain, Yugoslavia

Group III: Australia, Belgium, Canada, Czechoslovakia, German Democratic Republic, Hungary, India, the Netherlands, Sweden, Switzerland

Group IV: Federal Republic of Germany, France, Italy, Poland

Group V: Japan, U.K., USA, USSR

New: Nigeria; *Withdrawn*: Malay-Singapore. The 1974 General Assembly amended the Statutes such that the number of unit contributions in Groups I, II, III, IV, V, was to be 1, 2, 4, 7, 10 (instead of 1, 2, 3, 5, 8).

11 August 1978: 47 countries (Europe 26, Asia 9, North and South America 6, Africa 4, Australia and Oceania 2)

Group I: Argentina, Cameroon, China–Taiwan, Cuba, Arab Republic of Egypt, Greece, Iceland, Democratic People's Republic of Korea, Mexico, New Zealand, Nigeria, Norway, Philippines, Portugal, Singapore, Turkey

Group II: Austria, Brazil, Bulgaria, Denmark, Finland, Iran, Ireland, Israel, Pakistan, Romania, South Africa, Spain, Yugoslavia

Group III: Australia, Belgium, Canada, Czechoslovakia, German Democratic Republic, Hungary, India, the Netherlands, Sweden, Switzerland

Group IV: Italy, Poland

Group V: France, Federal Republic of Germany, Japan, U.K., USA, USSR

New: Arab Republic of Egypt, Cameroon, Iran, the Philippines, Singapore

9 August 1982: 51 countries (Europe 26, Asia 12, North and South America 7, Africa 4, Australia and Oceania 2)

Group I: Cameroon, China–Taiwan, Chile, Cuba, Arab Republic of Egypt, Greece, Hong Kong, Iceland, Iran, Democratic People's Republic of Korea, Republic of Korea, Mexico, New Zealand, Nigeria, Norway, Philippines, Portugal, Singapore, Turkey, Vietnam

Group II: Argentina, Austria, Bulgaria, Denmark, Finland, Ireland, Israel, Pakistan, Romania, South Africa, Spain, Yugoslavia

Group III: Australia, Belgium, Brazil, Canada, Czechoslovakia, German Democratic Republic, Hungary, India, the Netherlands, Sweden, Switzerland

Group IV: Italy, Poland

Group V: France, Federal Republic of Germany, Japan, U.K., USA, USSR

New: Chile, Hong Kong, the Republic of Korea, Vietnam

1 August 1986: 53 countries (Europe 26, Asia 13, North and South America 7, Africa 5, Australia and Oceania 2)

Group I: Cameroon, Chile, Cuba, Egypt, Greece, Hong Kong, Iceland, Iran, Ivory Coast, Democratic People's Republic of Korea, Republic of Korea, Malaysia, Mexico, New Zealand, Nigeria, Norway, Philippines, Portugal, Singapore, Turkey, Vietnam

Group II: Argentina, Austria, Bulgaria, Denmark, Finland, Ireland, Israel, Pakistan, Romania, South Africa, Spain, Yugoslavia

Group III: Australia, Belgium, Brazil, Czechoslovakia, Democratic Republic of Germany, Hungary, India, Netherlands, Poland, Sweden, Switzerland

Group IV: Canada, Italy

Group V: China, France, Federal Republic of Germany, Japan, U.K., USA, USSR

New: China, Ivory Coast, Malaysia; *Withdrawn*: China–Taiwan

August 1990: 52 countries (Europe 26, Asia 12, North and South America 7, Africa 5, Australia and Oceania 2); *withdrawn*: Malaysia

1 January 1995: 59 countries (Europe 30, Asia 13, North and South America 8, Africa 6, Australia and Oceania 2)

Group I: Armenia, Bulgaria, Cameroon, Croatia, Cuba, Egypt, Greece, Hong Kong, Iceland, Ivory Coast, Kazakhstan, Democratic Republic of Korea, New Zealand, Nigeria, Norway, Philippines, Portugal, Romania, Saudi Arabia, Singapore, Slovenia, Tunisia, Turkey, Venezuela, Vietnam

Group II: Argentina, Austria, Chile, Czech Republic, Denmark, Finland, Georgia, Iran, Ireland, Mexico, Republic of Korea, Slovak Republic, South Africa, Yugoslavia

Group III: Australia, Belgium, Brazil, Hungary, India, the Netherlands, Poland, Spain, Sweden, Switzerland

Group IV: Canada, Israel, Italy

Group V: China, France, Germany, Japan, Russia, United Kingdom, United States

New: Armenia, Croatia, Czech Republic, Georgia, Kazakhstan, Saudi Arabia, Slovak Republic, Slovenia, Tunisia, Venezuela; *Withdrawn*: Czechoslovakia, German Democratic Republic, Pakistan

2 General Assemblies of the IMU

The numbers in parentheses in the list below represent respectively the number of members of the IMU at the time of the Assembly and the number of member countries represented at the Assembly.

1st: Strasbourg, France, 20 September 1920 (11/11)

2nd: Toronto, Canada, 15 August 1924 (18/14)

(unofficial): Bologna, Italy, 9 September 1928 (21/13)

3rd: Zurich, Switzerland, 11 September 1932 (23/17)

1st: Rome, Italy, 6–8 March 1952 (22/18)

2nd: The Hague, the Netherlands, 31 August–1 September 1954 (30/26)

3rd: St. Andrews, Scotland, U.K., 11–13 August 1958 (36/29)

4th: Saltsjöbaden, Sweden, 11–13 August 1962 (37/31)

5th: Dubna, USSR, 13–16 August 1966 (41/32)

6th: Menton, France, 28–30 August 1970 (42/31)

7th: Harrison Hot Springs, B.C., Canada, 17–19 August 1974 (42/30)

8th: Otaniemi, Finland, 11–12 August 1978 (47/40)

9th: Warsaw, Poland, 8–9 August 1982 (51/36)

10th: Oakland, California, USA, 31 July–1 August 1986 (52/43)

11th: Kobe, Japan, 18–19 August 1990 (52/43)

12th: Lucerne, Switzerland, 31 July–1 August 1994 (57/53)

3 Executive Committees of the IMU

1919–1920 (Interim Executive Committee)

Honorary Presidents: H. Lamb, E. Picard, V. Volterra

President: Ch. de la Vallée Poussin

Vice-President: W.H. Young

Secretaries: Th. de Donder, G. Koenigs, M. Petrovich, V. Reina

Members: A. Demoulin, J. de Ruyts, J.W.L. Glashier, H. Parenty, M. Stuyvaert

1920–1924

Honorary Presidents: C. Jordan (1920–1922), H. Lamb, E. Picard, V. Volterra

President: Ch.-J. de la Vallée Poussin

Vice-Presidents: P. Appell, L. Bianchi, L.E. Dickson, J. Larmor, W.H. Young

Secretary General: G. Koenigs

Treasurer: A. Demoulin

1924–1932

Honorary Presidents: L.E. Dickson, J.C. Fields, H. Lamb, G. Mittag-Leffler (1924–1927), E. Picard, Ch.-J. de la Vallée Poussin, V. Volterra

President: S. Pincherle (1924–1928), W.H. Young (1929–1932)

Vice-Presidents: P. Appell, G.A. Bliss, H. Fehr, L.E. Phragmén, W.H. Young (1924–1929)

Secretary General: G. Koenigs (1924–1931)

Treasurer: A. Demoulin

1950–1952 (Interim Executive Committee)

Secretary: B. Jessen

Members: E. Bompiani, M. Brelot, W.V.D. Hodge, D.D. Kosambi, K. Kuratowski, M.H. Stone

1952–1954

President: M.H. Stone

Vice-Presidents: E. Borel (First), E. Kamke (Second)

Secretary: E. Bompiani

Members: W.V.D. Hodge, S. Iyanaga, B. Jessen

1955–1958

President: H. Hopf

Vice-Presidents: A. Denjoy (First), W.V.D. Hodge (Second)

Secretary: E. Bompiani (1955–1956), B. Eckmann (1956–1958)

Members: K. Chandrasekharan, J.F. Koksma, S. Mac Lane

1959–1962

President: R. Nevanlinna

Vice-Presidents: P.S. Aleksandrov, M. Morse

Secretary: B. Eckmann (1959–1961), K. Chandrasekharan (1961–1962)

Members: K. Chandrasekharan (1959–1961), C. Choquet, H. Kneser, J.F. Koksma, K. Kuratowski

Past President: H. Hopf

1963–1966

President: G. de Rham

Vice-Presidents: H. Cartan, K. Kuratowski

Secretary: K. Chandrasekharan

Members: J.C. Burkill, F. Hirzebruch, M.A. Lavrentiev, D. Montgomery, B. Segre

Past President: R. Nevanlinna

1967–1970

President: H. Cartan

Vice-Presidents: M.A. Lavrentiev, D. Montgomery

Secretary: O. Frostman

Members: M.F. Atiyah, K. Chandrasekharan, G. Hajós, E. Vesentini, K. Yosida

Past President: G. de Rham

1971–1974

President: K. Chandrasekharan

Vice-Presidents: A.A. Albert (1971–1972), N. Jacobson (1972–1974), L.S. Pontryagin

Secretary : O. Frostman

Members: M.F. Atiyah, Y. Kawada, N.H. Kuiper, M. Nicolescu, E. Vesentini

Past President: H. Cartan

1975–1978

President: D. Montgomery

Vice-Presidents: J.W.S. Cassels, M. Nicolescu (1975–1976), G. Vranceanu (1976–1978)

Secretary: J.-L. Lions

Members: E. Bombieri, M. Kneser, O. Lehto, M. Nagata, L.S. Pontryagin

Past President: K. Chandrasekharan

1979–1982

President: L. Carleson

Vice-Presidents: M. Nagata, Yu.V. Prohorov

Secretary: J.-L. Lions

Members: E. Bombieri, J.W.S. Cassels, M. Kneser, O. Lehto, Cz. Olech

Past President: D. Montgomery

1983–1986

President: J. Moser

Vice-Presidents: L.D. Faddeev, J-P. Serre

Secretary: O. Lehto

Members: S. Mizohata, G.D. Mostow, M.S. Narasimhan, Cz. Olech, J. Palis Jr.

Past President: L. Carleson

1987–1990

President: L.D. Faddeev

Vice-Presidents: W. Feit, L. Hörmander

Secretary: O. Lehto

Members: J. Coates, H. Komatsu, L. Lovász, J. Palis Jr., C.S. Seshadri

Past President: J. Moser

1991–1994

President: J.-L. Lions

Vice-Presidents: J. Coates, D. Mumford

Secretary: J. Palis Jr.

Members: J. Arthur, A. Dold, H. Komatsu, L. Lovász, E. Zehnder

Past President: L.D. Faddeev

1995–1998

President: D. Mumford

Vice-Presidents: V. Arnol'd, A. Dold

Secretary: J. Palis Jr.

Members: J. Arthur, S. Donaldson, B. Engquist, S. Mori, K.R. Parthasarathy

Past President: J.-L. Lions

4 Meetings of the IMU Executive Committees

1953: Paris

1954: Paris, the Hague

1955: Zurich

1956: Paris, Paris

1957: Zurich, Zurich

1958: London, Edinburgh, Lausanne

1959: Copenhagen

1960: Paris

1961: Düsseldorf, Princeton

1962: Rome, Saltsjöbaden

1963: Lausanne

1964: Geneva

1965: Paris

1966: Locarno, Dubna

1967: Oxford

1968: Paris

1969: Pisa

1970: Lausanne, Menton, Nice

1971: Zurich, Moscow

1972: London

1973: Frankfurt am Main, Zurich

1974: Harrison Hot Springs

1975: Paris

1976: Paris

1977: Cambridge (England)

1978: Paris, Otaniemi

1979: Paris

1980: Paris

1981: Paris

1982: Paris, Warsaw, Paris

1983: Helsinki

1984: Zurich

1985: Paris

1986: Paris, Oakland

1987: Leningrad

1988: Rio de Janeiro

1989: Paris

1990: Cambridge (England), Kobe

5 Central Committees of the International Commission on the Teaching of Mathematics

1908–1912

President: F. Klein

Vice-President: G. Greenhill

Secretary General: H. Fehr

1912–1920

President: F. Klein

Vice-Presidents: G. Greenhill, D.E. Smith

Secretary General: H. Fehr

Members: (co-opted 1913) G. Castelnuovo, E. Czuber, J. Hadamard

1928–1932

President: D.E. Smith

Vice-Presidents: G. Castelnuovo, J. Hadamard

Secretary General: H. Fehr

Member: W. Lietzmann

1932–1936 and 1936–

President: J. Hadamard

Vice-Presidents: P. Heegaard, W. Lietzmann, G. Scorza

Secretary General: H. Fehr

Member: (co-opted 1932) E.H. Neville

In 1936 the Central Committee and the Commission received the mandate until the next International Congress of Mathematicians. By Fehr's interpretation, the Commission was still in existence in 1952 when it became attached to the IMU as a subcommission.

6 Executive Committees of ICMI

1952–1954

Honorary President: H. Fehr

President: A. Châtelet

Vice-Presidents: G. Kurepa, S. Mac Lane

Secretary: H. Behnke

Members: A.F. Andersen, G. Ascoli, E.W. Beth, R.L. Jeffery, E.A. Maxwell

Ex officio: M.H. Stone

Behnke, Châtelet, Fehr, Jeffery, and Kurepa were elected by the 1952 General Assembly of the IMU without specifying their offices. The Commission itself chose the officers and co-opted additional members later in 1952. The name International Commission on Mathematical Instruction (ICMI), which had sometimes been used in 1952–1954, was officially introduced by the 1954 IMU General Assembly, which also adopted the terms of reference for ICMI. According to the By-Laws, the President of the IMU is an ex officio member of all Commissions of the Union.

1955–1958

President: H. Behnke

Vice-Presidents: G. Kurepa, M.H. Stone

Secretary: J. Desforge

Members: Ram Behari, E.A. Maxwell, K. Piene

Ex officio: H. Hopf (President of IMU)

1959–1962

President: M.H. Stone

Vice-Presidents: H. Behnke, G. Kurepa

Secretary: G. Walusinski

Members: Y. Akizuki, A.D. Aleksandrov, O. Frostman

Ex officio: R. Nevanlinna (President of IMU)

1963–1966

President: A. Lichnerowicz

Vice-Presidents: E. Moise, S. Straszewicz

Secretary: A. Delessert

Members: Y. Akizuki, H. Behnke, H. Freudenthal

Ex officio: G. de Rham (President of IMU)

1967–1970

President: H. Freudenthal

Vice-Presidents: E. Moise, S.L. Sobolev

Secretary: A. Delessert

Members: H. Behnke, A. Revuz, B. Thwaites

Ex officio: H. Cartan (President of IMU)

The 1970 IMU General Assembly decided that the Past President of ICMI, the Secretary of the IMU, and the representative of the Union in the ICSU Committee on the Teaching of Science (CTS) shall be members ex officio of the Executive Committee of ICMI.

1971–1974

President: M.J. Lighthill

Vice-Presidents: S. Iyanaga, J. Suranyi

Secretary: E.A. Maxwell

Members: H.O. Pollak, S.L. Sobolev

Ex officio: H. Freudenthal (Past President of ICMI), K. Chandrasekharan (President of IMU), O. Frostman (Secretary of IMU), A. Lichnerowicz (CTS/ICSU)

1975–1978

President: S. Iyanaga

Vice-Presidents: B. Christiansen, H.G. Steiner

Secretary: Y. Kawada

Members: E.G. Begle, L.D. Kurdjavcev

Ex officio: M.J. Lighthill (Past President of ICMI), Deane Montgomery (President of IMU), J.-L. Lions (Secretary of IMU), H. Freudenthal (CTS/ICSU)

1979–1982

President: H. Whitney

Vice-Presidents: U. D'Ambrosio, B. Christiansen

Secretary: P. Hilton

Members: S.H. Erlwanger, B.H. Neumann, Z. Semadeni

Ex officio: S. Iyanaga (Past President of ICMI), L. Carleson (President of IMU), J.-L. Lions (Secretary of IMU), B. Christiansen (CTS/ICSU)

1983–1986

President: J.-P. Kahane

Vice-Presidents: B. Christiansen, Z. Semadeni

Secretary: A.G. Howson

Members: B.F. Nebres, M.F. Newman. H.O. Pollak

Ex officio: H. Whitney (Past President of ICMI), J. Moser (President of IMU), O. Lehto (Secretary of IMU), H. Hogbe-Nlend (CTS/ICSU)

1987–1990

President: J.-P. Kahane

Vice-Presidents: Lee Peng-Yee, E. Lluis Riera

Secretary: A.G. Howson

Members: H. Fujita, J. Kilpatrick, M. Niss

Ex officio: L. Faddeev (President of IMU), O. Lehto (Secretary of IMU), J.H. van Lint (CTS/ICSU)

1991–1994

President: M. de Guzmán

Vice-Presidents: J. Kilpatrick, Lee Peng-Yee

Secretary: M. Niss

Members: Yu.L. Ershov, E. Luna, A. Sierpinska

Ex officio: J.-P. Kahane (Past President of ICMI), J.-L. Lions (President of IMU), J. Palis (Secretary of IMU), J.H. van Lint (CTS/-ICSU)

7 Commissions on Development and Exchange

1979–1982

Chairman: H. Hogbe-Nlend

Members: M. Atiyah, A.J. Coleman, D. Guedes de Figueiredo, K. Ito, G.D. Mostow, B. Szőkefalvi-Nagy, M.S. Narasimhan, A.D. Pogorelov

Ex officio: L. Carleson (President of IMU), J.-L. Lions (Secretary of IMU)

1983–1986

Chairman: H. Hogbe-Nlend

Members: R. Ayoub, J. Céa, J.O.C. Ezeilo, A. Figá-Talamanca, D. Guedes de Figueiredo, Hoang Tuy, M. Immanaliev, Lee Peng-Yee

Ex officio: J. Moser (President of IMU), O. Lehto (Secretary of IMU)

1987–1990

Chairman: M.S. Narasimhan

Members: J.P. Bourgignon, Ph. Griffiths, M. Immanaliev, A.O. Kuku, Lê Dung Tràng, S. Murakami, A. Simis, G. Vidossich

Ex officio: L. Faddeev (President of IMU), O. Lehto (Secretary of IMU)

1991–1994

Chairman: M.S. Narasimhan

Members: P. Bérard, C. Camacho, A. Grunbaum, A.O. Kuku, J. Mawhin, T. Ochiai, P.L. Papini, Wu Wen-Tsün

Ex officio: J.-L. Lions (President of IMU), J. Palis Jr. (Secretary of IMU)

8 International Congresses of Mathematicians

1897: Zurich, Switzerland

1900: Paris, France

1904: Heidelberg, Germany

1908: Rome, Italy

1912: Cambridge, England, U.K.

1920: Strasbourg, France

1924: Toronto, Canada

1928: Bologna, Italy

1932: Zurich, Switzerland

1936: Oslo, Norway

1950: Cambridge, Massachusetts, USA

1954: Amsterdam, the Netherlands

1958: Edinburgh, Scotland, U.K.

The mathematical program was determined before the 1962 Congress by the local Organizing Committee, for the ICM-62 and thereafter by a Consultative Committee (CC), which in 1982 was renamed Program Committee (PC). The members of the CC and PC are appointed partly by the IMU Executive Committee, partly by the local Organizing Committee. For the ICM-62, the CC was still advisory to the OC; thereafter, it had the sole authority for the scientific program. Since the 1962 Congress, the President of the IMU appoints its Chairman. For the ICMs 1966, 1970, and 1974, the IMU Executive Committee and the local OC each appointed four of the eight members. For the ICMs 1978, 1983, 1986, and 1990, the local OC could appoint two, three, or four members according to the decision of the IMU Executive Committee, which appointed the rest. Since 1990, the IMU Executive Committee has appointed seven members, the local OC, two.

1962: Stockholm, Sweden

Consultative Committee:

Chairman: de Rham

IMU: P.S. Aleksandrov, Chandrasekharan, Eckmann, Hodge, Hopf, Montgomery, Morse

Sweden: Carleson, Frostman, Gårding, Hörmander, Pleijel

1966: Moscow, USSR

Consultative Committee:

Chairman: Nevanlinna

IMU: Borel, Choquet, Gårding, Milnor

USSR: Kolmogorov, Linnik, Pontryagin, Vekua

1970: Nice, France

Consultative Committee:

Chairman: Albert

IMU: Jablonskii (succeeding Mergelyan in 1969), Kuiper, Mackey, Yosida

France: Bruhat, Leray, Lions, Serre

1974: Vancouver, Canada

Consultative Committee:

Chairman: Hörmander

IMU: Hirzebruch, Jablonskii, Jacobson, L. Schwartz

Canada: Gratzer, Heilbronn, Hull, Husain

1978: Helsinki, Finland

Consultative Committee:

Chairman: Borel

IMU: Adams, Chern, Kawada, Malgrange, S.M. Nikolskii, Olech

Finland: Lehto, Louhivaara

1983: Warsaw, Poland

Consultative Committee:

Chairman: Serre

IMU: Atiyah, W. Browder, Deligne, Faddeev, Winograd

Poland: Bojarski, Cièsielski, Lojasiewicz

1986: Berkeley, California, USA

Program Committee:

Chairman: Hirzebruch

IMU: Carleson, Rabin, Rozanov, Ruelle

USA: Bombieri, Mumford, Nirenberg, Singer

1990: Kyoto, Japan

Program Committee:

Chairman: Kuiper

IMU: Arnol'd, Connes, Graham, Langlands, Quillen

Japan: Hironaka, Kashiwara, Mizohata

1994: Zurich, Switzerland

Program Committee:

Chairman: Nirenberg

IMU: Donaldson, Drinfeld, Karp, Majda, Raynaud, Sato, Sinai

Switzerland: de la Harpe, Kraft

9 Fields Medals

For the Congresses 1936–1958, the local Organizing Committee appointed the Fields Medal Committees (FMC). For the ICM-1962, the FMC was appointed by the Consultative Committee of the Congress. After that, the FMCs have been appointed by the Executive Committee of the IMU.

1936:

Medalists: Ahlfors, Douglas

Fields Medal Committee: Severi (Chairman), Carathéodory, G.D. Birkhoff, E. Cartan, Takagi

1950:

Medalists: Selberg, L. Schwartz

Fields Medal Committee: Bohr (Chairman), Ahlfors, Borsuk, Fréchet, Hodge, Kolmogorov, Kosambi, Morse

1954:

Medalists: Kodaira, Serre

Fields Medal Committee: Weyl (Chairman), Bompiani, Bureau, H. Cartan, Ostrowski, Pleijel, Szegő, Titchmarsh

1958:

Medalists: Roth, Thom

Fields Medal Committee: Hopf (Chairman), Chandrasekharan, Friedrichs, P. Hall, Kolmogorov, L. Schwartz, Siegel, Zariski

1962:

Medalists: Hörmander, Milnor

Fields Medal Committee: Nevanlinna (Chairman), P.S. Aleksandrov, Artin, Chern, Chevalley, Whitney, Yosida

1966:

Medalists: Atiyah, Cohen, Grothendieck, Smale

Fields Medal Committee: de Rham (Chairman), Davenport, Deuring, Feller, Lavrentiev, Serre, Spencer, Thom

1970:

Medalists: Baker, Hironaka, Novikov, Thompson

Fields Medal Committee: H. Cartan (Chairman), Doob, Hirzebruch, Hörmander, Iyanaga, Milnor, Shafarevich, Turán

1974:

Medalists: Bombieri, Mumford

Fields Medal Committee: Chandrasekharan (Chairman), Adams, Kodaira, Malgrange, Mostowski, Pontryagin, Tate, Zygmund

1978:

Medalists: Deligne, Fefferman, Margulis, Quillen

Fields Medal Committee: Montgomery (Chairman), Carleson, Eichler, I.M. James, Moser, Prohorov, Szőkefalvi-Nagy, Tits

1982:

Medalists: Connes, Thurston, Yau

Fields Medal Committee: Carleson (Chairman), Araki, Malliavin, Marchuk, Mumford, Nirenberg, Schintzel, C.T.C. Wall

1986:

Medalists: Donaldson, Faltings, Freedman

Fields Medal Committee: Moser (Chairman), Deligne, Glimm, Hörmander, Ito, Milnor, Novikov, Seshadri

1990:

Medalists: Drinfeld, V.F.R. Jones, S. Mori, Witten

Fields Medal Committee: Faddeev (Chairman), Atiyah, Bismut, Bombieri, Fefferman, Iwasawa, Lax, Shafarevich

1994:

Medalists: Bourgain, P.-L. Lions, Yoccoz, Zelmanov

Fields Medal Committee: Mumford (Chairman), Caffarelli, Kashiwara, B. Mazur, Schrivjer, Sullivan, Tits, Varadhan

10 Rolf Nevanlinna Prizes

The Nevanlinna Prize Committee (NPC) is appointed by the IMU Executive Committee.

1982:

Medalist: Tarjan

Nevanlinna Prize Committee: J.-L. Lions (Chairman), Salomaa, J. Schwartz

1986:

Medalist: Valiant

Nevanlinna Prize Committee: Faddeev (Chairman), Cook, Winograd

1990:

Medalist: Razborov

Nevanlinna Prize Committee: Lovász (Chairman), Chorin, Rabin, Strassen

1994:

Medalist: Wigderson

Nevanlinna Prize Committee: J.-L. Lions (Chairman), Lenstra, Matiyasevic, Tarjan, Yamaguti

11 Union Lectures

The lectures were published in *L'Enseignement Mathématique.*

1. W.M. Schmidt. Approximation to algebraic numbers. Princeton, N.J., USA, February 1971. *L'Enseignement Mathématique* 19, 1972.

2. L. Hörmander. On the existence and the regularity of solutions of linear pseudodifferential equations. Princeton, N.J., USA, March–April 1971. *L'Enseignement Mathématique* 18, 1971.

3. F. Hirzebruch. Hilbert modular surfaces. Tokyo, Japan, February–March 1972. *L'Enseignement Mathématique* 21, 1973.

4. J.-L. Lions. Sur le contrôl optimal de systèmes distribués. Moscow, USSR, November 1972. *L'Enseignement Mathématique* 20, 1973.

5. D. Mumford. Stability of projective varieties. Bures-sur-Yvette, France, March–April 1976. *L'Enseignement Mathématique* 24, 1977.

6. A. Vitushkin. On representation of functions by means of superpositions and related topics. Los Angeles, California, USA, April–May 1977. *L'Enseignement Mathématique* 25, 1978.

7. H. Furstenberg. Les frontières de groupes et leurs applications. Bures-sur-Yvette, France, 1980. Not published.

8. W. Jaco. Varietés de dimension 3. Lausanne, Switzerland, 1981. Not published.

9. S.T. Yau. Nonlinear analysis in geometry. Zurich, Switzerland, November 1981. *L'Enseignement Mathématique* 33, 1986.

10. M. Kashiwara. Introduction to microlocal analysis. Bern, Switzerland, June 1984. *L'Enseignement Mathématique* 32, 1986.

11. E. Bombieri. Questions of effectivity in number theory. Zurich, Switzerland, June 1986. Not published.

12. V. Arnol'd. Contact geometry and wave propagation. Oxford, England, November–December 1988. *L'Enseignement Mathématique* 34, 1993.

12 Finances

In 1952–1974, the unit contribution was defined in terms of the gold franc. It was given a precise value in U.S. dollars, which was the principal currency of the IMU. From 1975 on, the unit contribution has been determined in Swiss francs (CHF). In the years 1975–1982, the Secretary's financial reports were still presented in terms of the dollar, and most of the Union's expenditures were in dollars. After 1982, the Swiss franc became predominant in the transactions of the IMU, while the dollar was used in the Union's reports to ICSU.

The following overview of the Union's income in dollars is based on the Secretary's reports, the Consumer Price Index of the United States, and the average annual exchange rates CHF/US $.

Years	Unit Contribution	in 1993 dollars	Average Annual Income (US $)	in 1993 dollars
1953–1954	200 gold francs ($65.20)	350	13,800	73,800
1955–1958	$65.20	340	14,700	75,000
1959–1962	$65.20	315	15,600	77,600
1963–1966	$97.80	450	18,200	83,800
1967–1970	$97.80	390	23,200	92,900
1971–1974	$130.40	430	28,300	92,100
1975–1978	CHF 600 ($265)	640	63,300	153,400
1979–1982	CHF 600 ($330)	570	74,800	129,800
1983–1986	CHF 850 ($395)	545	90,400	124,200
1987–1990	CHF 1000 ($670)	805	148,800	176,100
1991–1993	CHF 1100 ($765)	790	210,700	217,100

13 Archives (as of June 1996)

The files of the IMU are stored at the Central Archives of the University of Helsinki, where they are at the disposal of researchers. The material is divided into numbered sections as follows:

1. The old IMU
2. Foundation of the new IMU
3. General Assemblies
4. Executive Committees
5. (National) Adhering Organizations
6. Correspondence (President and Secretary)
7. International Congresses of Mathematicians
8. Program (Consultative) Committees
9. Fields Medals
10. Rolf Nevanlinna Prizes
11. Union Lectures
12. IMU Conferences
13. IMU Bulletins
14. International Commission on Mathematical Instruction
15. Exchange Commission
16. Commission on Development and Exchange

17. Travel Grants and Special Development Fund
18. History of Mathematics
19. World Directory of Mathematicians
20. Projects
21. Human rights
22. Finances
23. International Council of Scientific Unions
24. Other organizations
25. Tapes, films, photographs

Notes

[1] Minutes of the 54th meeting of the Executive Committee of the IMU, St. Catherine's College, 6–7 April 1990, Cambridge, United Kingdom. IMU Archives.

[2] K. Chandrasekharan, *The prehistory of the International Mathematical Union.* An unpublished handwritten manuscript of 31 March 1990.

[3] Minutes of the 59th meeting of the Executive Committee of the IMU, 14–15 April 1994, Budapest, Hungary. IMU Archives.

[4] Dirk J. Struik, *A Concise History of Mathematics.* London, G. Bell and Sons, Ltd. 1965. General remarks on the development of mathematics in the nineteenth century are on pp. 201–203.

[5] Frank Greenaway, *Science International. A history of the International Council of Scientific Unions.* Cambridge University Press 1996.

[6] Hélène Gispert, *La France mathématique. La Société mathématique de France (1872–1914).* Société Française d'Histoire des Sciences et des Techniques & Société Mathématique de France, 1991. In addition to discussing the scope of mathematical production with the aid of the statistics provided by the *Jahrbuch über die Fortschritte der Mathematik*, the author considers the distribution of mathematical publications by country, with emphasis on the contribution of French mathematics.

[7] *Jahrbuch über die Fortschritte der Mathematik*, Erster Band, Jahrgang 1868. Herausgegeben von Dr. Carl Orthmann und Dr. Felix Müller. Berlin, Druck und Verlag von Georg Reimer 1871.

[8] G. Eneström, "Ueber die neuesten mathematisch-bibliographischen Unternehmungen." *Verhandlungen des ersten Internationalen Mathematiker-Kongresses in Zürich vom 9. bis 11. August 1897.* Herausgegeben von Dr. Ferdinand Rudio. Leipzig, Teubner 1898, pp. 281–288.

[9] *Encyklopädie der mathematischen Wissenschaften mit Einschluss ihrer Anwendungen.* Erster Band, Teil 1. Leipzig, Druck und Verlag von B. G. Teubner 1898–1904. Preface by Walther von Dyck, München 1904.

[10] Karen Hunger Parshall, "Mathematics in National Contexts (1875–1900): An International Overview." *Proceedings of the International Congress of Mathematicians, August 3–11, 1994, Zürich, Switzerland*, pp. 1581–1589. Birkhäuser Verlag. An abbreviated text of the invited lecture, of which another version under the title "How We Got Where We Are: An International Overview in National Contexts (1875-1900)" was published in the *Notices of the American Mathematical Society* 43 (3), March 1996. This description and analysis of mathematical research in various countries illustrates the process of internationalization in the last decades of the nineteenth century.

[11] Walter Purkert und Hans Joachim Ilgauds, *Georg Cantor 1845–1918*, pp. 127–128 and 219–223. Birkhäuser Verlag, Basel-Boston-Stuttgart, 1987. Here, as elsewhere, direct English quotations from non-English sources are translations by the author.

[12] Georg Cantor, *Briefe*, Herausgegeben von Herbert Meschkowski und Wilfried Nilson. Springer-Verlag, 1991, pp. 350–353, 376–378, and 384–385.

[13] Joseph Warren Dauben, *Georg Cantor: His Mathematics and Philosophy of the Infinite*, pp. 163–165, 339. Harvard University Press, 1979.

[14] *Mathematical papers read at the International Mathematical Congress held in connection with the World's Columbian Exposition Chicago 1893.* Edited by E. Hastings Moore, Oskar Bolza, Heinrich Maschke, and Henry S. White. New York, Macmillan and Co. for the American Mathematical Society 1896. This was the first book published by the American Mathematical Society.

[15] *L'Intermédiaire des mathématiciens*, dirigé par C.-A. Laisant et Emile Lemoine. Tome I, 1894, pp. vi, 113.

[16] C.-A. Laisant, "Les mathématiques au Congrès de l'Association Française pour l'Avancement des Sciences à Bordeaux." *Revue Général des Sciences*, Janvier 1896, pp. 31–34.

[17] *Verhandlungen des ersten Internationalen Mathematiker-Kongresses in Zürich vom 9. bis 11. August 1897.* Herausgegeben von Dr. Ferdinand Rudio. Leipzig, Teubner 1898. The main source of information for the ICMs are the official "Proceedings," which have been published after each ICM. See also Donald J. Albers, G.L. Alexanderson, and Constance Reid, *International Mathematical Congresses, an Illustrated History 1893–1986.* Springer-Verlag, New York, 1987, and June Barrow-Green, "International Congresses of Mathematicians from Zürich 1897 to Cambridge 1912." *The Mathematical Intelligencer* 16 (2), Springer-Verlag, New York, 1994.

[18] E. Neuenschwander, "International Mathematical Congresses from Zürich 1897 to Zürich 1994. A historical survey and an introduction to the ICHM-Symposium." Preprint of the lecture given at the ICM 94 Zurich.

[19] *Compte Rendu du Deuxième Congrès International des Mathématiciens, tenu à Paris du 6 au 12 août 1900.* Procès-verbaux et communications Publiés par E. Duporcq, Paris, Gauthier-Villars, Imprimeur-Libraire, 1902.

[20] *Verhandlungen des dritten Internationalen Mathematiker-Kongresses in Heidelberg vom 8. bis 13. August 1904.* Heruasgegeben von dem Schriftführer des Kongresses Dr. A. Krazer. Leipzig, Druck und Verlag von B. G. Teubner, 1905.

[21] *Atti del IV Congresso Internazionale dei Matematici (Roma, 6–11 Aprile 1908)*, publicati par G. Castelnuovo. Vol. I. Roma, Tipografia della R. Accademia dei Lincei, 1909.

[22] H. Fehr, "La Commission Internationale de l'Enseignement Mathématique de 1908 à 1920." *L'Enseignement Mathématique 1920*, pp. 305–318.

[23] *Proceedings of the Fifth International Congress of Mathematicians (Cambridge, 22–28 August 1912).* Edited by the General Secretaries of the Congress E.W. Hobson and A.E.H. Love, vol. I, part I. Cambridge at the University Press 1913.

[24] Letter of 11 November 1918 from Mittag-Leffler to Professor N.E. Nörlund. Archives of the Mittag-Leffler Institute, Djursholm, Sweden. The Mittag-Leffler Institute possesses a vast collection of Mittag-Leffler's letters. In the letters dealing with international science policy in 1918–1921, Mittag-Leffler discloses his feelings in greatest detail

to his Danish colleague N.E. Nörlund (in 1918 Professor in Lund, Sweden, later in Copenhagen) and the Finnish Ernst Lindelöf, Professor in Helsinki. The correspondence with Nörlund and Lindelöf is in Swedish.

[25] The Wiesbaden meeting was held under the leadership of the Prussian Academy (Preussische Akademie der Wissenschaften). In 1893 it had been one of the initiators in the formation of the Kartell, which it did not join itself until 1906. In 1992 the Academy was renamed Berlin-Brandenburgische Akademie der Wissenschaften.

[26] "Summary of Correspondence relating to Conference on International Conventions after the War." Archives of the Royal Society. The paper is not signed, but from the contents it is clear that it was written by Sir Arthur Schuster.

[27] Royal Society. Preliminary Report of Inter-Allied Conference on International Scientific Organizations. Held at the Royal Society on 9–11 October 1918. Archives of the Royal Society. That the draft text for the Declaration was written by Schuster appears from the minutes of a Special Meeting of the Council of the Royal Society held on 3 October 1918. (*Royal Society—Minutes of Council 1914–1920*, Vol. 11, pp. 326–329.)

[28] Greenaway [5] gives special credit for the idea to establish scientific unions to the American G.E. Hale and the British A. Schuster. Hale was said to have used as his model the existing international organization in astronomy and the U.S. National Research Council.

[29] *Union Académique Internationale, UAI, Seventy-fifth Anniversary.* Brussels, Palais des Académies, 1995.

[30] *Conseil International de Recherches 1919*, vol. I. Constitutive Assembly held at Brussels, 18–28 July 1919. Report and Proceedings edited by Sir Arthur Schuster, F. R. S., General Secretary. London, Harrison & Sons, April 1920.

[31] An untitled and undated thirty-three-page article by W.H. Young about the International Research Council. Archives of the University of Liverpool. It is partly a descriptive account based on specified references, partly a personal (and critical) analysis of the Council. Young himself mastered French; he lived permanently in the French-speaking part of Switzerland. For the tip that the papers of W.H. Young are deposited in the Archives of the University of Liverpool I am indebted to June Barrow-Green. Adrian Allan, the Archivist of the University of Liverpool, permitted copies to be made for the IMU of all papers related to the IRC or IMU.

[32] See [30]. The official statutes in French are printed in extenso on pp. 155–159, their English translation on pp. 222–226.

[33] "Die deutsche Wissenschaft und das Ausland." Denkschrift der Reichszentrale für naturwissenschaftliche Berichterstattung vom 29. Januar 1925. Archives of the Berlin-Brandenburgische Akademie der Wissenschaften.

[34] Brigitte Schroeder-Gudehus, *Les scientifiques et la paix. La communauté scientifique internationale au cours des années 20.* Les Presses de l'Université de Montréal, 1978.

[35] A report on the IMU session is on p. 26 of the work cited in note [30]. The participants were delegates who were mathematicians or close to mathematics. "Projet de Statuts pour une Union Internationale de Mathématiciens" is on pp. 185–189, and its English translation on pp. 247–250.

[36] Letter of 8 March 1921 from Mittag-Leffler to Professor Eliakim H. Moore, Chicago. Archives of Mittag-Leffler Institute. A few years later, Mittag-Leffler discussed International Congresses in his address at the 1925 Scandinavian Congress of Mathematicians, in Copenhagen. In his account, the fifth ICM, in 1912, was followed by the sixth in 1924 (to whose organization in Toronto he had given his consent). He made no mention of the Strasbourg Congress—not a word. Mittag-Leffler's address is published in Swedish in the Proceedings of the Copenhagen congress, and in German, under the title "Entstehung und Entwicklung der internationalen and skandinavischen Mathematikerkongresse," in *Commentationes Physico-Mathematicae, Societas Scientiarum Fennicae*, Tomus III. Helsinki, 1926.

[37] Raymond Clare Archibald, *A Semicentennial History of the American Mathematical Society 1888–1938.* New York, American Mathematical Society 1938.

[38] *Comptes Rendus du Congrès International des Mathématiciens*, Strasbourg 22–30 Septembre 1920. Publiés par Henri Villat. Toulouse 1921. The Proceedings contain an account of the first meeting of the IMU on 20 September 1920.

[39] A French copy of the Draft Statutes of the IMU ([35]) was among the papers of W.H. Young at the University of Liverpool. On this copy Young had written the modifications made by the Strasbourg General Assembly, of which he was a member. At the end he wrote, *"Ces statuts ont été définitivement adoptés le 20 septembre 1920, au cours de l'A.g. tenue à Strasbourg."* Archives of the University of Liverpool.

[40] Jean Mawhin, "En marge d'un anniversaire et d'une inauguration: le mathématicien louvaniste Charles-Jean de la Vallée Poussin." *Louvain* 88-2, 1988, pp. 12–14. This is a concise biography of the first President of the IMU.

[41] A. Buhl (Toulouse), "Gabriel Koenigs," in *L'Enseignement Mathématique* 1931, pp. 286–287 is an obituary, and Hélène Gispert, "Koenigs Gabriel, 1858–1931, professeur de mécanique 1923–1931," *Les professeurs du Conservatoire national des arts et métiers. Dictionnaire biographique 1794–1955*, A–K, sous la direction de Claudine Fontanon et André Grelon, a biography. Dr. Gispert told me that the papers of Koenigs in the archives of the French Academy of Sciences say nothing about the affiliation of Koenigs with the IMU. Later, I verified this myself.

[42] Emile Picard, "Le Congrès international de Mathématiques de Strasbourg." *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences* 171, Juillet–Décembre 1920, pp. 589–591.

[43] Joseph W. Dauben, "Mathematicians and World War I: The international diplomacy of G.H. Hardy and Gösta Mittag-Leffler as reflected in their personal correspondence." *Historia Mathematica* 7 (1980), pp. 261–288.

[44] Letter of 17 June 1918 from Hale to Schuster. Archives of the Royal Society.

[45] Letter of 27 November 1919 from Mittag-Leffler to E. Lindelöf. Archives of Mittag-Leffler Institute. Mittag-Leffler had a great ambition to succeed in the many endeavors to which he applied his organizational skills. The judgments of many of his contemporaries about his person were not positive.

Mittag-Leffler spoke in sharp terms about Picard, the leading figure of the discriminatory science policy, in a great number of letters. Yet Mittag-Leffler did not touch on science policy at all in his letters to Picard himself. The collection of Mittag-Leffler's papers contains ninety-seven letters written by Picard. After 1914 the correspondence between Picard and Mittag-Leffler was infrequent. The few letters, which Mittag-Leffler began as before with "Mon cher Ami," dealt primarily with personal matters, condolences, and illnesses. (Picard's elder son was killed in the war, and soon thereafter one of his daughters died. Mittag-Leffler's wife died shortly after the war. Both Picard and Mittag-Leffler had been seriously ill. In 1926 Picard's remaining son died from tuberculosis.) A letter of 1926 from Picard is the only one in which science policy was briefly mentioned (see [58]).

[46] Letter of 3 October 1921 from Mittag-Leffler to Hardy. Archives of Mittag-Leffler Institute. A lively correspondence developed between Mittag-Leffler and Hardy, the two outspoken supporters of unrestricted internationalism (cf. [43]). Mittag-Leffler thought that true internationalism would soon return "in spite of the violent opposition of Picard, who is worse than all the others."

[47] The invitation to Strasbourg was sent under the imprimatur *Congrès International des Mathématiciens.* Mittag-Leffler (and independently, Young) felt that this was a *lapsus linguae*, since the Strasbourg Congress was not open to all mathematicians: The word *des* (of the) should be replaced by *de* (of). The Congress accepted the proposed change, and in the first note in the *Comptes Rendus* the form *de* was used. However, in the Proceedings the word *des* was restored. In 1924, when the former enemies were still excluded, the wording "International Mathematical Congress" was used. The linguistic conundrum disappeared in 1928, when the Congress was again open to all mathematicians, irrespective of nationality. Mittag-Leffler discussed the "*de* vs. *des*" problem in several letters—with Landau, Lindelöf, Nörlund, and Moore.

[48] Conrad Grau, "Die Wissenschaftsakademien in der deutschen Gesellschaft: Das 'Kartell' von 1893 bis 1940." *Acta historica Leopoldina* 22, 1995, pp. 31–56. This comprehensive article contains a rather detailed description of the German views about international science policy. While visiting Berlin in June 1996 I profited from discussions with Professor Grau.

[49] Letter of 20 July 1926 from Pincherle to Mittag-Leffler. Archives of Mittag-Leffler Institute. Pincherle writes, *Il n'est pas possible de réunir de Bureau et les communications par correspondence prennent beaucoup de temps, d'autant plus que notre excellent secrétaire-général M. Koenigs ne se presse pas beaucoup de répondre.*

[50] In the vast collection of letters from the Unions to the Secretary General of the International Research Council, which are deposited in the Library of the Royal Society, I did not find a single letter from the IMU. For the Union's visibility among mathematicians, see [41, 70].

[51] *Proceedings of the International Mathematical Congress* held in Toronto, 11–16 August 1924, edited by J.C. Fields, vol. I. Toronto, The University of Toronto Press, 1928.

[52] "Quotations—International Congresses (Professor G.H. Hardy in the *Scientific Worker*)." *Science*, 26 December 1924, pp. 591–592.

[53] J.L. Synge, "John Charles Fields." *Journal of the London Mathematical Society* 8, part 1. January 1933, pp. 153–160.

[54] See [51], pp. 65–66. Phragmén is listed as Vice-President on p. 66, but on p. 65 he is replaced by Holmgren. There is ample evidence that the Vice-President was Phragmén (President Pincherle's letters [49, 55], Vice-President Fehr's reports in *L'Enseignement Mathématique* in 1924 and 1929, and W.H. Young's correspondence).

[55] Pincherle's letter of 1 September 1925 to Volterra. *Vito Volterra e il suo tempo (1860–1940)*, pp. 156–157. Mostra storica-documentaria. Catalogo a cura di Giovanni Paoloni. Roma 1990.

[56] Conseil International de Recherches. Troisième Assemblée Générale tenue au Palais des Académies, à Bruxelles, du 7 au 9 juillet 1925. Procès-verbaux des Séances. Archives of the Royal Society.

[57] Conseil International de Recherches. Assemblée Générale Extraordinaire tenue au Palais des Académies, Bruxelles, le 29 juin 1926. Procès-verbal de la Séance. Archives of the Royal Society.

[58] Letter of 23 July 1926 from Picard to Mittag-Leffler: *"Vous savez ce que nous avons fait à Bruxelles; c'était une opération nécessaire, mais je m'y suis prêté sans enthousiasme."* Archives of the Mittag-Leffler Institute.

[59] "Denkschrift der kartellierten Akademien über den Conseil International de Recherches." Appendix to the letter of 29 May 1927 from the Sächssische Akademie der Wissenschaften, Leipzig, to das Auswärtige Amt (Foreign Ministry). Archives of the Berlin-Brandenburgische Akademie der Wissenschaften. In this appendix the Kartell listed the reasons why Germany should not join the IRC.

[60] "Internationale Assoziation der Akademien." A report on international science policy in relation to Germany in the years 1920–1927. Archives of the Berlin-Brandenburgische Akademie der Wissenschaften. See also [34]. Steklov was an internationalist in the academic circles of postrevolutionary Russia. He was elected Vice-President of the Russian Academy of Sciences in 1919, and an Institute of Physics and Mathematics was founded at the Academy at his proposal. After Steklov's death, in 1926, the Institute was given his name. It was retained for the Mathematics Institute when independent Institutes were formed for mathematics and physics in 1934. During the 1924 Congress, the honorary degree of D.Sc. was conferred by the University of Toronto on Steklov (and some other Congress members, among them de la Vallée Poussin and Koenigs).

[61] Sir Harold Spencer Jones, "The Early History of ICSU." *ICSU Review* 2 (4), 1960, pp. 169–187.

[62] Protokoll der Kartelltagung in Wien am 10. Juni 1932. Archives of the Berlin-Brandenburgische Akademie der Wissenschaften.

[63] Letter of 20 July 1926 from Pincherle to Mittag-Leffler. Archives of the Mittag-Leffler Institute.

[64] The letter of 16 May 1928 from the Gesellschaft der Wissenschaften zu Göttingen and the answer of 22 May 1928 from the Preussische Akademie der Wissenschaften. Archives of the Berlin-Brandenburgische Akademie der Wissenschaften.

[65] Constance Reid, *Hilbert*, p.188. Springer-Verlag, Berlin, Heidelberg, New York, 1970.

[66] *Atti del Congresso Internazionale dei Matematici Bologna, 3–10 Settembre 1928 (VI)*. Bologna, Nicola Zanichelli, Editore, 1929. An account of the organization of the Congress is given (in Italian) on pp. 5–10. Pincherle's letter to Picard, written in French, is published in extenso in a footnote.

[67] Undated "Memorandum" by W.H. Young. Archives of the University of Liverpool.

[68] Union Internationale Mathématique. Compte rendu de la réunion officieuse tenue à Bologne le 9 septembre 1928, signed by H. Fehr. IMU Archives. Also published in Italian in [66], p. 83.

[69] Séance du Bureau de l'Union, signed by H. Fehr and approved by Pincherle and Young. IMU Archives. Also published in a slightly abbreviated form by H. Fehr under the title "Union Internationale Mathématique" in *L'Enseignement Mathématique* 1929, pp. 50–51.

[70] Pincherle's work in the Union has been overlooked in his own country. In the comprehensive memoir *Salvatore Pincherle, Opere scelte*, a cura della Unione Matematica Italiana, vol. I, Edizione Cremonese, Roma 1954, Pincherle's actions as chief organizer of the Bologna Congress are mentioned and his efforts for science and universality praised. "At the culmination of his life, having completed the noble mission, he descended the chair to which he had brought so much honor, in silent sadness...." In contrast, not a word was said about his four-year presidency of the IMU. This is one more proof that the old IMU must have been an organization with poor visibility. (Cf. [41, 50].)

[71] Letter of 29 January 1929 from Fehr to Young. Archives of the University of Liverpool.

[72] Letter of 6 February 1929 from Ch. de la Vallée Poussin to Young. Archives of the University of Liverpool.

[73] Georges Valiron acted as secretary of the meeting of the 1932 General Assembly of the IMU. At the time of the meeting, Valiron was acquainted with the affairs of the Union, but the documents at my disposal do not tell when he started working for the IMU. Vice-President Fehr, in his account of the General Assembly ([83]), called Valiron *secrétaire provisoire* or *secrétaire de l'Assemblée* (not *de l'Union*).

[74] G.H. Hardy, "William Henry Young." *Journal of the London Mathematical Society* 17 (1942), pp. 218–237. Also in Hardy's Collected Papers, vol. VII. pp. 771–790.

[75] In a letter of 23 January 1995, the Secretary General of the University of Geneva, M. André Vifian, wrote about Dr. Jean-Jacques Fehr, the son of Professor Henri Fehr: *"Monsieur Fehr souvient fort bien que son père a été en conflit avec un mathématicien anglais, William Young, au sujet de la réintegration de certains pays membres exclus de l'International Mathematical Union, dont l'Allemagne en particulier."* Asked about this, Dr. Fehr himself wrote in his letter to me of 10 March 1995, only this: *"Le professeur W. H. Young était un ami de mon père et tous deux collaborerent étroitement à maintes reprises."*

[76] Letter of 31 January 1929 from Young to Carathéodory. Archives of the University of Liverpool.

[77] Letter of 19 February 1929 from Young to Lyons. Archives of the University of Liverpool.

[78] International Research Council. Proposed Draft Statutes of Professor W.H. Young laid before the Meeting of the Executive Committee at Paris in July 1930 as an alternative to those drawn up by a Commission appointed for that purpose, pp. 1–9. Archives of the University of Liverpool.

[79] Memorandum on the Draft Statutes of the International Research Council, pp. 1–35, and five Appendices. Archives of the University of Liverpool.

[80] Extract from a letter from Knopp to Young: *"L. Bieberbach schreibt mir (20. 6. 29)."* Archives of the University of Liverpool.

[81] I. Grattan-Guinness, "A Mathematical Union: William Henry and Grace Chisholm Young." *Annals of Science* 29 (2), August 1972, pp. 105–186.

[82] Union Internationale Mathématique. Mémoire rédigé par M. Young et M. de la Vallée Poussin, le 21 février 1931. In addition to a typed copy, a handwritten version without signatures exists. The handwriting is de la Vallée Poussin's. Archives of the University of Liverpool.

[83] H. Fehr, "Union Internationale Mathématique. Troisième Assemblée Générale tenue à Zurich le 11 septembre 1932. Résumé du compte rendu rédigé par le secrétaire de l'Assemblée, M. Valiron." *L'Enseignement Mathématique* 1 (31), 1933, pp. 276–278. The account contains an obvious error. Its list of the twelve member countries of the Union at the time of the 1928 Bologna meeting is deficient. The number twelve does not agree with the remark a couple of lines later that with Denmark having withdrawn in 1930 and Bulgaria and Hungary having joined after 1928, the IMU had twenty-one members. The number twenty-one is in accordance with the minutes of the meeting of the 1928 General Assembly signed by Fehr. In it, countries present were mentioned, and Fehr had added by hand the names of the other member countries, arriving at the total of twenty. (The printed minutes of the Bologna meeting gives the figure nineteen.) However, Fehr's list of the twenty did not include Greece, which joined the IMU in 1920 and was a member and represented in 1932; nor Egypt, present in 1932. It seems that in 1932, the IMU had twenty-three members. (For lists, see the Appendix, Section 1.)

[84] R.G.D. Richardson, "International Congress of Mathematicians, Zurich 1932." *Bulletin of the American Mathematical Society*, November 1932, pp. 769–774.

[85] See [83]. Fehr's protest was a separate appendix to the minutes.

[86] Letter from Henri Cartan of 23 September 1994 to me. About the dissolution of the IMU, Cartan wrote, *"... c'est au Congrès de Zürich de 1932 qu'il a été décidé, sous la pression des Américains, de mettre fin à son existence. Je participais à ce Congrès et je me rappelle combien mon père* [the French delegate Elie Cartan] *était attristé par cette fâcheuse décision."*

[87] *Verhandlungen des Internationalen Mathematikerkongresses Zürich 1932.* Herausgegeben von Prof. Dr. Walter Saxer. Orell Füssli Verlag, Zürich und Leipzig.

[88] Letter of 5 February 1936 from Julia to Picard. Archives of the French Academy of Sciences. Julia wrote, *"A la question de M. Cavalier vous pouvez répondre que l'Union internationale existe encore et qu'il y a lieu de continuer à verser la subvention habituelle...."*

[89] Henry S. Tropp, "The origins and history of the Fields medal." *Historia Mathematica* 3, 1976, pp. 167–181. The author gives some indication of tense relations between Mittag-Leffler and Nobel but remarks that such stories are undocumented and have the character of gossip.

Elisabeth Crawford, in *The Beginnings of the Nobel Institution, The Science Prizes 1901–1915*, Cambridge University Press, 1984, discusses at some length the theme of Mittag-Leffler, Nobel, and the Nobel Prizes. The picture painted of Mittag-Leffler is such that antipathy between Mittag-Leffler and Nobel could well have existed. A brief reference is made "to the myth that Nobel had planned to institute a prize in mathematics but refrained because of his antipathy for Mittag-Leffler," and further, "Although both the 'missing prize' in mathematics and the exclusion of the Högskola from Nobel's final will probably angered Mittag-Leffler, he did not show this publicly. He may have taken his revenge privately by spreading the story of how Nobel, who was fifteen years his senior, had lost out in their presumed rivalry over a woman." On the other hand, Crawford writes that the polite letters Nobel and Mittag-Leffler exchanged during their lifetimes seem to belie the assumption of a rift between the two.

[90] Lars Gårding and Lars Hörmander, "Why is There No Nobel Prize in Mathematics?" *The Mathematical Intelligencer* 7 (3), 1985, pp. 73–74. In the article, a clear stand is taken on the question posed in the title. Dismissing any role of Mittag-Leffler, the authors write, "The true answer to the question is that, for natural reasons, the thought of a prize in mathematics never entered Nobel's mind.... Mathematics was simply not one of Nobel's interests." Kjell-Ove Widman, the present Director of the Mittag-Leffler Institute, shares this view. In a letter of 1 April 1996 to me, he wrote that no documentary evidence is known to corroborate Mittag-Leffler's influence. Widman added, however, that there is a wealth of material in Kungliga Biblioteket among Mittag-Leffler's business papers that have hardly been touched. Nobel died in 1896, and the first Nobel prizes were awarded in 1901. As a member of the Royal Academy of Sciences, Mittag-Leffler took an active part in the selection of the prizewinners.

[91] J.C. Fields, "International Medals for Outstanding Discoveries in Mathematics." A copy of this undated memorandum is in the IMU Archives.

[92] H. Fehr, "Le 10e Congrès International des Mathématiciens. Oslo, 13–18 juillet 1936." *L'Enseignement Mathématique* 1936, pp. 373–377.

[93] *Comptes Rendus du Congrès International des Mathématiciens, Oslo 1936. Tome I, Procès-Verbaux et Conférences Générales.* A.W. Broggers Boktrykkeri A/S, Oslo, 1937.

[94] *Deutsche Mathematik*, edited by Theodor Vahlen, began to appear in 1936. The preface of the first volume is still moderate in its tone. Having given credit to mathematical research outside Germany, it

concluded, *"Für die Anregung und Belehrung, die sich daraus auch für uns ergibt, hat unsere Zeitschrift einen offenen Blick. Doch sehen wir alles unter den Gesichtspunkten der mathematischen Leistung unseres Volkes."* William M. Shirer, in *The Rise and Fall of the Third Reich*, Secker and Warburg, London, 1962, devotes a section to "Education in the Third Reich." Of *Deutsche Mathematik* he writes (p. 250), "The first editorial solemnly proclaimed that any idea that mathematics could be judged nonracially carried within itself the germs of the destruction of German science." The quotation is not from the first editorial, but the tenor is typical of many articles in the journal.

[95] "Kartellsitzung in Wien am 24. November 1938." Archives of the Berlin-Brandenburgische Akademie der Wissenschaften.

[96] In Germany there were several reasons to distinguish between the Union Académique Internationale (UAI) and ICSU. The Kartell favored the UAI because it was itself more oriented towards humanities than sciences, the members of the UAI were academies, and it was a priori clear that the Germans would have an important position in UAI affairs. For the German government, the presence of Germany in certain international historical projects was of importance. In contrast, ICSU's past was not forgiven before the Second World War. In speaking against joining ICSU in 1938, the Prussian Academy referred to ICSU by its old name, the International Research Council. (See [95].)

[97] Nathan Reingold, "Refugee Mathematicians in the United States of America, 1933–1941: Reception and Reaction," an article in *A Century of Mathematics in America*, American Mathematical Society, 1989, part I, pp. 175–200. This is a systematic study of the subject indicated in the title, with some references to the British effort as well. In the same volume, Lipman Bers, himself a refugee, wrote in the article "The migration of European Mathematicians to America," p. 231, "The migration of European mathematicians to the United States in the late thirties and early forties was an unqualified success. It was good for the Europeans; that is quite an understatement: for most it was a question of life or death, and for all it was a question of professional survival. It was good for American mathematics, though at the time it was not at all clear that it would turn out to be so. And it was good for mathematics."

[98] *Proceedings of the International Congress of Mathematicians, Berkeley, California, August 3–11, 1986.* Edited by Andrew M. Gleason. American Mathematical Society 1987, p. xxv.

[99] Everett Pitcher, *A History of the Second Fifty Years 1939–1988*, American Mathematical Society 1988, pp. 147–148.

[100] *Bulletin of the American Mathematical Society* 51 (1945) and 52 (1946), Providence, R.I., USA.

[101] See [99], p. 148.

[102] *Proceedings of the International Congress of Mathematicians, Cambridge, Massachusetts, U.S.A., August 30–September 6, 1950*, volume I. Editorial Committee Lawrence M. Graves, Einar Hille, Paul A. Smith, Oscar Zariski. American Mathematical Society 1952, pp. 121–145.

[103] Extracts from Minutes of Committee on International Scientific Unions of National Research Council, April 19, 1947. Brown University Library, Marshall Stone Papers pertaining to the International Mathematical Union. Later also, Stone took up the theme of early Congresses and the IMU. His writings make interesting reading but, with few references to original sources, must be taken with a grain of salt. In 1983 Stone explained to me his work in the Union in a tête-à-tête in the lobby of Hotel Grande Bretagne in Athens. Not knowing that I would one day write the history of the IMU, I did not take notes. Therefore, there are no traces in my text of this interesting meeting with Stone. The long chain of people who helped me in locating Stone's papers at Brown University included Garrett Birkhoff and, repeatedly, David Mumford. At the end of the chain was Liliane Beaulieu, of Montreal, who even knew the numbers of the boxes in which the papers pertaining to the IMU were stored. Microfilms for the IMU were made courtesy of Mark Brown, the Archivist of Brown University.

[104] Letter of 7 February 1947 from F.J.M. Stratton to John A. Fleming. Brown University Library, Marshall Stone Papers pertaining to the International Mathematical Union.

[105] Garrett Birkhoff, "Marshall Stone's Harvard Years." Harvard University Archives.

[106] Letter written by M.H. Stone on behalf of the Policy Committee for Mathematics. A copy, dated 1 November 1948, in which the recipient is not specified, is in the IMU Archives.

[107] Copy of an undated letter addressed to "Dear Colleague" and signed M.H. Stone. IMU Archives. From other contexts and a later mailing list it can be deduced that [106] is what Stone called "Communication I" and this one is "Communication II." In this letter the foundation for the draft statutes of the planned Union was laid.

[108] Letter of 19 August 1949 from Stone. IMU Archives. This long letter, still addressed to "Dear Colleague" rather than to National Committees, contains a wealth of information about the remarks that had been made on the draft text of the statutes and by-laws.

[109] Letter of 24 March 1950 from Stone to the National Committees concerning the proposed International Mathematical Union. IMU Archives.

[110] Letter of 10 December 1949 from W.L.G. Williams to Stone. Brown University Library, Marshall Stone papers pertaining to the International Mathematical Union.

[111] Letter of 8 September 1949 to Stone from Niles W. Bond, Acting Chief, Division of Northeast Asian Affairs. Brown University Library, Marshall Stone papers pertaining to the International Mathematical Union.

[112] Letter of 3 November 1949 from Prof. Dr. Kamke, Vorsitzender der DMV, to Stone. Brown University Library, Marshall Stone papers pertaining to the International Mathematical Union.

[113] Letter of 15 November 1949 from Stone to Prof. Dr. E. Kamke. Brown University Library, Marshall Stone papers pertaining to the International Mathematical Union.

[114] Letter of 2 February 1950 from Stone to Prof. Dr. E. Kamke. Brown University Library, Marshall Stone papers pertaining to the International Mathematical Union.

[115] Letter of 24 November 1949 from M. Brelot to Stone. Brown University Library, Marshall Stone papers pertaining to the International Mathematical Union.

[116] Marshall H. Stone, "International relations in mathematics," *Graduate Studies Texas Tech University, Men and Institutions in American Mathematics*, No. 13. Edited by J. Dalton Tarwater, John T. White, and John D. Miller. Lubbock, Texas, October 1976, pp. 31–39. In Stone's files from the years 1947–1951 at the Brown University Library I did not find any letter from Mandelbrojt or Kuratowski. There were Stone's complaints that it had not been possible to contact Kuratowski, who was appointed a member of the Steering Committee to prepare the New York meeting and who became a member of the Interim Executive Committee of the IMU. I do not know how the views of Kuratowski, who was a stout internationalist, reached Stone in 1949–1950.

[117] K. Chandrasekharan, "Marshall Stone." An extempore (recorded) speech delivered at a testimonial dinner held in honor of Professor M.H. Stone, at the Quadrangle Club of the University of Chicago, 22 May 1968. A copy was sent to me by Chandrasekharan.

[118] Letter of 26 May 1950 from the Policy Committee for Mathematics, signed by Marston Morse, Chairman, and J.R. Kline, Secretary. Brown University Library, Marshall Stone papers pertaining to the International Mathematical Union.

[119] Letter of 18 July 1950 from Stone to the Steering Committee of the Union Conference. Brown University Library, Marshall Stone papers pertaining to the International Mathematical Union.

[120] "Enabling Resolution." Appendix to the printed document "International Mathematical Union" circulated by the Royal Danish Academy in December 1950. IMU Archives. Jessen pointed out that the list of participants first produced and circulated contained some errors. The list in the Enabling Resolution was produced after Kline, in a letter to Jessen, admitted that the corrections Jessen proposed should be made.

[121] Jessen was in correspondence with A. von Muralt, President of ICSU; F.J.M. Stratton, Secretary General of ICSU; R. Fraser, Liaison Bureau ICSU-UNESCO; and P. Auger, Director, Department of Natural Sciences, UNESCO.

[122] Letter of 10 September 1951 from Börge Jessen to the National Adhering Organizations of the IMU. IMU Archives.

[123] Letter of 6 December 1951 from Börge Jessen to the National Adhering Organizations of the IMU. IMU Archives.

[124] Elsa Gerlini, *Villa Farnesina alla Lungara Rome.* N 2 New Series, Guides to museums, galleries and monuments. Istituto poligrafico e zecca dello Stato, Rome, 1990. The official record of the General Assembly erroneously speaks of Palazzo Farnesina. The building, completed in 1509, may deserve the title "Palazzo," but it is called Villa Farnesina, or La Farnesina. In letters written in Rome in March 1952 to his wife and to his mother, the U.S. Delegate Saunders Mac Lane praised the meeting place: "... magnificent old building over on the wrong side of the Tiber—wonderful murals...." The pictured *Salone delle Prospettive* is not mentioned in the report of the General Assembly. In 1995, the Delegates Henri Cartan and Saunders Mac Lane could no longer remember where exactly the sessions of the General Assembly had been held. When I visited Villa Farnesina in June 1995, my Italian hosts said that the *Salone delle Prospettive*

must have been the place, being the only room in the building with enough space for meetings of around fifty persons. There is a Palazzo Farnese in Rome. It houses the French Embassy and has never been connected with the Accademia Nazionale dei Lincei.

[125] B. Jessen, "International Mathematical Union. Record of the First General Assembly held on 6–8 March 1952 in Rome in the Palazzo Farnesina by invitation of the Accademia Nazionale dei Lincei." IMU Archives. Published in a slightly abbreviated version in *Internationale Mathematische Nachrichten* 19/20, 1952, pp. 16–20.

[126] Letter of 26 March 1952 from Einar Hille to Professor Enrico Bompiani. IMU Archives.

[127] Letter of 20 October 1953 from Henri Cartan to E. Bompiani, Secretary of the International Mathematical Union. IMU Archives.

[128] Report of Prof. Richard Courant, dated 19 February 1959. Among the papers of the meeting of the IMU Executive Committee in Copenhagen in 1959. IMU Archives.

[129] That Stone was the obvious candidate for the first President of the new IMU was confirmed by Mac Lane in a letter of 20 June 1995 to me. In his letters of March 1952 to his wife and to his mother, Mac Lane described, among other things, discussions preceding the election of the Secretary.

[130] Marshall H. Stone, "The International Mathematical Union and its work." Report of the first session held in Rome, *La Ricerca Scientifica* of the Italian Research Council (October 1952).

[131] If the Unites States Consumer Price Index was 100 in 1953, it was 535 in 1993. In 1993, the exchange rate Swiss franc/U.S.$ was 1.48. A list of the annual income of the IMU in 1953–1993 is given in the Appendix, Section 12. For reasons of comparison, the figures are also presented in the computed 1993 values. For the formulas required for the transformations I am indebted to Edgar Reich.

[132] Enrico Bompiani, "Annual Report of the Executive Committee to the National Adhering Organizations, concerning the period March 9, 1952–February 14, 1953. *Internationale Mathematische Nachrichten* 27/28, 1953, Union News, pp. 4–10.

[133] Letter of 30 June 1952 from Stone to Bompiani. IMU Archives. More precisely, Georges Valiron, who had been made responsible for the financial assets of the suspended Union in 1932, had sent a sum of 108,065 French francs (approximately equivalent to $350), and the heirs of the late Professor Demoulin, the Treasurer of the old Union since 1920, a smaller sum (about $100) in Belgian francs. (See [132].)

[134] International Mathematical Union, signed KC:sg:12.3.64. Included in the material of the nineteenth meeting of the Executive Committee, Geneva, 9–10 July 1964. IMU Archives.

[135] Letter of 27 August 1952 from Stone to Bompiani and Jessen. IMU Archives.

[136] Letter of 1 April 1952 from Bompiani to the Secretary General of the International Council of Scientific Unions (ICSU). IMU Archives.

[137] *IMU, Bulletin of the International Mathematical Union* 36, Special Number, June 1994, Secretariat, IMPA, Rio de Janeiro, p. 5.

[138] G. Kurepa, "Internationale Mathematische Unterrichtskommission (IMUK)." *Internationale Mathematische Nachrichten* 27/28, 1953, Union News, pp. 10–11.

[139] At its first meeting, the Executive Committee of the IMU adopted the following resolution: "Without any commitment as to financial support, the Executive Committee approves the proposal of the International Commission on the Teaching of Mathematics to adopt *L'Enseignement Mathématique* as its organ of publication." In the preceding discussion, the EC had felt that the Commission could not have made the decision alone.

[140] Letter of 5 November 1952 from Stone to Bompiani. IMU Archives.

[141] Letters of 8 and 13 July 1953 from Bompiani to Stone. The first letter contains an excerpt of a letter of 23 June 1953 from Behnke to Bompiani. IMU Archives.

[142] Letter of 7 August 1953 from Stone to Bompiani. IMU Archives.

[143] Letter of 31 May 1954 from Hodge to Stone. IMU Archives.

[144] Enrico Bompiani, "International Mathematical Union. Record of the Second General Assembly held on 31 August–1 September 1954 at the Hague (Binnenhof)." IMU Archives. Published also in *Internationale Mathematische Nachrichten* 35/35, November 1954, "Union News," pp. 4–14.

[145] *Proceedings of the International Congress of Mathematicians 1954, Amsterdam, September 2–9,* volume I. Erven P. Noordhoff N.V., Groningen, North-Holland Publishing Co., Amsterdam, 1957, pp. 127–161.

[146] "Report of the Executive Committee to the National Adhering Organizations, covering the period from June 1, 1956 to May 31, 1958." *Internationale Mathematische Nachrichten* 57/58, September 1958, Bulletin of the International Mathematical Union, pp. 1–2.

[147] *Proceedings of the International Colloquium on the Theory of Functions*, Helsinki 1957. Suomalainen Tiedeakatemia 1958. Nevanlinna was Chairman of the Organizing Committee, of which President Hopf was a member. Practical arrangements were my responsibility. This led to my first contact with the IMU through a letter of 26 March 1956 to Secretary Bompiani. It dealt with IMU support to the Helsinki Colloquium, which was badly needed for travel grants, since Finnish currency was not yet convertible at the time. For the same reason, an IMU contribution has been and still is of great value in a large number of cases.

[148] Letter of 12 October 1960 from Professor Dr. Gerhard Hess to Sir Rudolph Peters, President of the International Council of Scientific Unions, with a copy to Professor B. Eckmann. IMU Archives.

[149] Letter of 11 May 1962 from R. Nevanlinna to Prof. Dr. G. Rienäcker, Deutsche Akademie der Wissenschaften zu Berlin, Ost-Berlin. IMU Archives.

[150] Letter of 5 June 1962 from G. Rienäcker to Nevanlinna. IMU Archives.

[151] Letter of 20 December 1962 from Prof. Dr. W. Haack, President of the Deutsche Mathematiker-Vereinigung, to Nevanlinna. IMU Archives.

[152] Agenda for the 19th meeting of the Executive Committee of the IMU (held in Geneva, 9–10 July 1964). IMU Archives.

[153] *Internationale Mathematische Nachrichten* 45/46, August 1956, Bulletin of the International Mathematical Union, pp. 1–2.

[154] On 5 November 1996, Professor Lo Yang, of Academia Sinica, wrote to me, "At that time, China didn't give a positive answer, since the USSR and the East European countries were not members of the IMU."

[155] Letter of 18 November 1955 from Hua Loo-keng, Chairman, the Standing Council, the Chinese Mathematical Society, to E. Bompiani. IMU Archives.

[156] Letter of 28 February 1957 from Hua Loo-keng, President, the Chinese Mathematical Society, to B. Eckmann. IMU Archives.

[157] Letter of 8 May 1957 from B. Eckmann to Hua Loo-keng. IMU Archives.

[158] Letter of 3 August 1957 from Hua Loo-keng to B. Eckmann. IMU Archives.

[159] Extract from the Minutes of the Executive Committee Meeting, 15 October 1957, signed by H. Hopf, President of the IMU, and B. Eckmann, Secretary of the IMU. Appendix to a letter of 2 November 1957 from B. Eckmann to Hua Loo-keng. IMU Archives.

[160] Letter from Professor W.W.D. Hodge to President H. Hopf, May 1958. IMU Archives.

[161] Letter from Secretary Eckmann to Professor Kwan of 6 June 1958. IMU Archives.

[162] Letter from Professor Kwan to Secretary Eckmann of 24 June 1958. IMU Archives.

[163] Undated letter from Secretary Eckmann to Professor Kwan. IMU Archives.

[164] Letter with appendices from B. Eckmann to the National Adhering Organizations of the IMU of 30 December 1958. IMU Archives.

[165] A report by Enrico Bompiani, Secretary of the IMU, on the World Directory of Mathematicians. *Internationale Mathematische Nachrichten* 29/30, December 1953, Union News, p. 5.

[166] Letter of 3 June 1955 from C.M. Hutt, Scientific Publishing manager, Butterworths Publications Ltd., to E. Bompiani. IMU Archives.

[167] Letter of 2 June 1956 from Hopf to Stone with an undated and untitled Appendix written on the stationery of the Istituto Matematico, Città Universitaria, Roma. IMU Archives.

[168] Letter of 22 June 1956 from Stone to Hopf. IMU Archives.

[169] Letter of 1 March 1957 from Stone to Eckmann. IMU Archives.

[170] "World Directory of Mathematicians." A report of 25 September 1957 by Hodge addressed to J.F. Koksma, B. Eckmann, and J.A. Dieudonné. IMU Archives.

[171] Letter of 18 October from Eckmann to Hodge, with the Appendix "Extract from the Minutes, Item 3, World Directory." IMU Archives.

[172] Letter of 11 February 1958 from Chandrasekharan to Hopf. IMU Archives.

[173] Letter of 5 March 1958 from Chandrasekharan to Stone. IMU Archives.

[174] Letter of 4 April 1958 from Hopf to Chandrasekharan. IMU Archives.

[175] *World Directory of Mathematicians* 1958, published under the auspices of the International Mathematical Union and with the cooperation of the Tata Institute of Fundamental Research, Bombay.

[176] *World Directory of Mathematicians* 1961, published under the auspices of the International Mathematical Union and with the cooperation of the Tata Institute of Fundamental Research, Bombay.

[177] *World Directory of Mathematicians* 1966, published under the auspices of the International Mathematical Union and with the cooperation of the Tata Institute of Fundamental Research, Bombay.

[178] *IMU—Bulletin of the International Mathematical Union*, no. 1, January 1971, p. 16.

[179] *IMU—Bulletin of the International Mathematical Union*, no. 8, December 1974, pp. 5, 11.

[180] Minutes of the 36th Meeting of the Executive Committee of the International Mathematical Union, Collège de France, Paris, 22–29 May 1976. IMU Archives.

[181] *IMU—Bulletin of the International Mathematical Union*, no. 13 July 1978.

[182] Minutes of the 48th Meeting of the Executive Committee of the International Mathematical Union, 9–10 May 1985, Collège de France, Paris. IMU Archives.

[183] A circular letter from Professor David Mumford, Vice-President, International Mathematical Union, to the Chairs of the Committees for Mathematics of the IMU, dated 16 June 1993. Subject: *World Directory of Mathematicians*, 10th edition. IMU Archives.

[184] *World Directory of Mathematicians* 1994. 10th Edition. Published under the auspices of the International Mathematical Union. Distributed by the American Mathematical Society, ed. David Mumford.

[185] *Internationale Mathematische Nachrichten* 68/69, October 1961, Bulletin of the International Mathematical Union, pp. 20–21.

[186] *Internationale Mathematische Nachrichten* 51/52, August 1957, Bulletin of the International Mathematical Union, p. 2.

[187] *Internationale Mathematische Nachrichten* 57/58, September 1958, p. 13.

[188] *Internationale Mathematische Nachrichten* 57/58, September 1958, p. 3.

[189] Third General Assembly of the IMU, 11–13 August 1958, St. Salvator's College, St. Andrews, Scotland, Record of the Meeting. *Internationale Mathematische Nachrichten* 68/69, Oktober 1961, Bulletin of the International Mathematical Union, pp. 18–33. For me, the St. Andrews meeting was the first of my so far uninterrupted attendance at the IMU General Assemblies. The participation in the election of my own teacher, Rolf Nevanlinna, as President of the Union was an unforgettable experience.

[190] *Proceedings of the International Congress of Mathematicians, 14–21 August 1958.* Edited by J.A. Todd, F.R.S. Cambridge University Press, 1960.

[191] See [190], pp. i–li.

[192] Letter of 30 July 1958 from Hopf to Professor J. Sebastio e Silva. IMU Archives. This was an answer to a letter from Sebastio e Silva requesting information about the ICMs, in whose organization Portugal was interested.

[193] Letter from Lars Hörmander to Lennart Carleson (in Swedish). It is undated but was sent in December 1994. It contains quotations from letters written at the time the Stockholm ICM-1962 was being planned. IMU Archives.

[194] See [190], p. lv.

[195] *Proceedings of the International Congress of Mathematicians, 15–22 August 1962.* Institut Mittag-Leffler, Djursholm, Sweden. Printed by Almqvist & Wiksells Boktryckeri Aktiebolag, Uppsala 1963.

[196] Eleventh Meeting of the Executive Committee, Lausanne, 10–11 December 1958. *Internationale Mathematische Nachrichten* 68/69, Oktober 1961, pp. 12–14.

[197] Letter from K. Chandrasekharan to Heinz Hopf, 22 September 1960. IMU Archives.

[198] Letter from B. Eckmann to the Members of the Executive Committee, 12 December 1960. IMU Archives.

[199] Details are given in a letter of 21 February 1962 from Frostman to President Nevanlinna (in Swedish). IMU Archives.

[200] Minutes of the 14th Executive Committee Meeting Düsseldorf (Germany), 24–26 January 1961. IMU Archives.

[201] Letter from B. Eckmann to K. Chandrasekharan, 25 May 1961. IMU Archives. Traut Tischhauser, who had assisted Eckmann, continued as Office Secretary.

[202] Record of the Fourth General Assembly of the International Mathematical Union, Saltsjöbaden (Sweden), 11–13 August 1962. IMU Archives.

[203] Draft Minutes of the 14th Executive Committee Meeting Düsseldorf (Germany), 24–26 January 1961. IMU Archives.

[204] Report of the Executive Committee to the Fifth General Assembly of the International Mathematical Union. Dubna (USSR), 13–15 August 1966 (covering the period 1 June 1962–31 May 1966). IMU Archives.

[205] Minutes of the Fifth General Assembly of the International Mathematical Union, Dubna (USSR), 13–15 August 1966. IMU Archives.

[206] Minutes of the 21st meeting of the Executive Committee, Locarno, 5–6 May 1966. IMU Archives.

[207] The figures are from V.N. Trostnikov, Vsemirnii Kongress Matematikov v Moskve. "Znanie," Moskva 1967. According to the "List of Participants" of the Congress, as many as 5,594 mathematicians had preregistered.

[208] *Proceedings of the International Congress of Mathematicians, Moscow-1966.* Printing House "MIR," Moscow, 1968. Edited by I.G. Petrovsky. The text "MOCKBA 1966 ICM" is in big letters on the cover.

[209] Borel first told me about the initial difficulties of the Consultative Committee in an e-mail message of 1 April 1996. Later he sent letters written by Nevanlinna to the members of the Consultative Committee; they provide more details. These letters have been deposited in the IMU Archives.

[210] Rolf Nevanlinna, Muisteltua. Kustannusosakeyhtiö Otava, Helsinki 1976. Nevanlinna was unwilling to let these memoirs, written in Finnish, be translated. He had plans to write more mathematical memoirs for international readers.

[211] See [361] p. 35.

[212] Minutes of the 19th Meeting of the Executive Committee, Geneva, 9–10 July 1964. IMU Archives.

[213] *IMU—Bulletin of the International Mathematical Union*, No.39, December 1995. Intervention de Henri Cartan, pp. 29–32.

[214] *IMU—Bulletin of the International Mathematical Union*, No. 1, January 1971.

[215] Oral communication of 11 May 1995 in Paris by J-P. Serre to me.

[216] *Actes du Congrès International des Mathématiciens 1970*, vol 1. Gauthier-Villars Editeur, Paris, 1971.

[217] Minutes of the 26th Meeting of the Excutive Committee, Lausanne, 8–9 May 1970 (held at the Hotel Royal Savoy). IMU Archives.

[218] Cartan mentioned in a speech of 20 April 1989 in Paris that Chandrasekharan had persuaded Vinogradov to give a dinner in honor of Novikov. A typed copy of the speech in which Cartan told "what Professor Chandrasekharan did for the International Mathematical Union" is in the IMU Archives.

[219] Report of 16 June 1970 by Otto Frostman to the Site Committee for the International Congress of Mathematicians 1974. IMU Archives.

[220] See [213], p. 3.

[221] Minutes of the 29th Meeting of the Executive Committee, Hotel Storchen, Zurich, 14–16 May 1971. IMU Archives.

[222] Letter of 5 June 1997 from Maurice Sion (Chairman of the Local Arrangements Committee for the Vancouver Congress) to me. Sion wrote, "I do not remember the Union ever asking us to assume responsibility for the Proceedings.... If they had we would have gladly surrendered it."

[223] *IMU—Bulletin of the International Mathematical Union*, no. 2, September 1971.

[224] *IMU—Bulletin of the International Mathematical Union*, no. 5 September 1973.

[225] *IMU—Bulletin of the International Mathematical Union*, no. 4 December 1972, p. 6.

[226] *IMU—Bulletin of the International Mathematical Union*, no. 8, December 1974.

[227] Letter of 15 January 1973 from S. Jablonskii to the members of the Consultative Committee for the 1974 International Congress of Mathematicians in Vancouver. IMU Archives.

[228] Letter of 30 January 1973 from Lars Hörmander to S. Jablonskii. IMU Archives.

[229] Jablonskii's statement of 22 September 1974 to the Minutes of a meeting of the Consultative Committee for the 1974 International Congress of Mathematicians in Vancouver. Toronto, 19–20 September 1973, p. 16. IMU Archives. To the rather brusque draft text Jablonskii had added by hand a couple of conciliatory lines.

[230] Minutes of the 35th Meeting of the Executive Committee, 29–30 May 1975, Collège de France, Paris. The figures 41 and 21 are from a statement of six American members of the U.S. National Committee for Mathematics to President Montgomery, who reported them to the Executive Committee. From the Congress Proceedings ([232]) it is difficult to decipher these figures. IMU Archives.

[231] Minutes of the 33rd Meeting of the Executive Committee, Hotel zum Storchen, Zurich, 7–8 March 1974. IMU Archives.

[232] *Proceedings of the International Congress of Mathematicians, Vancouver 1974*, vol. 1, editor, Ralph D. James. Canadian Mathematical Congress 1975.

[233] Trust Agreement (of 18 April 1979) between the International Congress of Mathematicians and the Governing Council of the University of Toronto. IMU Archives.

[234] Letter and its appendices of October 1983 from Gloria J. Anderson, Administrative Officer—Trusts, University of Toronto, to Olli Lehto, Secretary of the International Mathematical Union. IMU Archives.

[235] Letter of 4 December 1984 from J. Douglas Coleman, Trust Officer, The National Victoria and Grey Trust Company, to Olli Lehto, Secretary of the IMU. IMU Archives. The five-page letter gives a detailed account of the state of the "J.C. Fields Trust" and arrangements concerning it.

[236] Of the 1,022-page *Proceedings of the ICM-78* [246], the invited mathematical addresses occupy more than 1,000 pages; the organization of the Congress is covered in a couple of pages. A rather complete sample of all Helsinki Congress material is collected in the IMU Archives. Most of it concerns the preparations: correspondence, minutes of meetings, various reports, printed material, etc. The collection is so voluminous that out of it could be created another thousand-page opus.

[237] The Rector was Ernst Palmén, Professor of Zoology, a long-time friend of mine.

[238] For many years, the Finnish National Committee for Mathematics consisted of only three members, P.J. Myrberg (1892–1976), Rolf

Nevanlinna (1895–1980), and me. Myrberg and Nevanlinna, who had both been my teachers, could not agree on who should be the chairman, Myrberg recommending Nevanlinna and vice versa. When the IMU insisted on knowing who it was, the two old gentlemen appointed me chairman in 1968. Both Myrberg and Nevanlinna refrained from expressing views about holding the Congress in Helsinki. Nevanlinna gave as a reason his advanced years, which would make uncertain his contribution to the arrangements. However, he could not quite conceal his wish that the decision be positive.

[239] During the 1974 IMU General Assembly in Harrison Hot Springs, I heard that Finland had a last-minute competitor for the ICM-1978. Secretary Frostman, who had at first been rather cool about Helsinki ("So soon in a Nordic country after the 1962 Congress in Stockholm?"), had become an ardent supporter of Helsinki and assured me that I need not be a bit worried.

[240] A concrete example of a case where both of the above aspects came into play and the positive one prevailed was the arranging of the City reception. Nevanlinna and I went to see the Lord Mayor, who graciously told us that the City of Helsinki would be only too happy to show hospitality to such a distinguished group of scholars. Unfortunately, a fourth person was present, a responsible administrator. He was smart enough to ask the question, "How many are you?" Having received the answer, he, overruling the Lord Mayor, advised us to forget the idea of a reception. According to the rules regarding security, City Hall could not be occupied by more than 1,500 persons. Out we went, but I decided to continue the fight. To make a long history short, the City arranged a reception with a good buffet dinner on two consecutive days. Each Congress member had to ask for an entrance ticket, which could be preordered in connection with the registration, on a first asked, first served basis. The tickets were of two colors, depending on the day. Fifteen hundred of each color were printed, and they were freely interchangeable between members of the Congress. Luckily, the demand was almost exactly equal to but not greater than the allowed maximum. The City Hall administrators did not quite trust me, however: They had installed an electronic counter at the entrance door.

[241] *IMU—Bulletin of the International Mathematical Union*, no. 14, October 1978

[242] Some months before his death, Nicolescu had been subjected to great pressure. As President of the Romanian Academy and the leading mathematician in his country, he had tried in vain to defend the position of the Institute of Mathematics of the Academy. By an order said to have come from Ceauşescu, the Institute was dissolved.

[243] The Otaniemi summer hotel was the largest in the Helsinki area offering rooms at moderate prices. They were badly needed for the Congress, where low-priced accommodation was in high demand. Dipoli and the hotel were under the same management, and thus a deal was concluded: For holding the General Assembly in Dipoli, we could reserve most of the hotel rooms for the ICM.

[244] Minutes of the meeting of the IMU Executive Committee, Paris, 29–30 May 1975. IMU Archives.

[245] Consultative Committee of the International Congress of Mathematicians 1978, first meeting, Helsinki, 2–3 June 1976. Draft minutes by A. Borel. IMU Archives.

[246] *Proceedings of the International Congress of Mathematicians, Helsinki 1978*, editor, Olli Lehto. Academia Scientiarum Fennica, Helsinki 1980.

[247] The Belgian Ambassador in Finland arranged a reception in honor of Deligne. The host and the other guests, including the parents of Deligne, were present, but not Deligne himself. Finally, he arrived, a bit breathless and not too formally dressed. He had come from his hotel to the Embassy by bicycle.

[248] An export permit was required for sending the paper. After the application had been submitted, a phone call from the agency reported that the amount of paper for which the license had been requested was astonishing. I had no time to interrupt and explain that five thousand copies of a two-volume work of over a thousand pages devours quite a bit of paper before I heard that I had set an all-time record: Nobody had ever requested an export permit for such a tiny amount.

[249] More precisely, "the British National Committee (12 February 1979) feels that the existing system works well. They regard it as very important that the essential principles should remain unchanged. In particular, they would strongly oppose any move towards the selection of speakers by their own countries." The message from the Federal Republic of Germany (DMV, 21 February 1979) was equally clear: The Mathematical Society "votes not to change the present system because it has proved to be the most effective in the past." The Americans wrote in the same spirit (7 March 1979): "The U.S. National Committee approves the present system of appointing a Consultative Committee and Advisory Panels consisting of individuals selected on purely scientific criteria." They called attention to the difficulties that had arisen after the invitations had been issued. The telegram from the National Committee of the German Democratic Republic was

sent on 29 March 1979. These and a few other replies are in the IMU Archives.

[250] Letter of 11 June 1979 from Carleson to the members of the Executive Committee. IMU Archives.

[251] Letter of 17 May 1979 from Vinogradov to Carleson. IMU Archives.

[252] Letter of 8 June 1979 from Olech to Vinogradov (in Russian). IMU Archives.

[253] Letter of 21 June 1979 from Olech to Carleson. IMU Archives.

[254] Correspondence between Carleson and Lions during 29 June–18 July, 1979, and Draft Memorandum of 26 July 1979 for the Consultative Committee for the 1982 Congress. IMU Archives.

[255] The quotations are from Cassels's letter of 7 August 1979 to Carleson. IMU Archives.

[256] Communiqué concerning negotiations between the Chairman of the Organizing Committee of the International Congress of Mathematicians (Warsaw 1982)—Corresponding Member of the Polish Academy of Science Professor Cz. Olech—and the President and Vice-President of the Soviet National Committee of Mathematicians—Academician I.M. Vinogradov and Academician L.S. Pontryagin (Moscow, 27 November 1979) (in Russian). IMU Archives.

[257] Communiqué concerning negotiations between the Chairman of the Organizing Committee of the International Congress of Mathematicians (Warsaw 1982)—Corresponding member of the Polish Academy of Science Professor Cz. Olech (People's Republic of Poland)—and representatives of Soviet scientific organizations (Moscow, 26–29 November 1979) (in Russian). IMU Archives. I received copies of these Moscow Communiqués [256, 257] from Olech.

[258] Minutes of the meeting of Professor L. Carleson and Academician I.M. Vinogradov and other representatives of the National Committee of Soviet Mathematicians (Moscow, 5–7 February 1980) (English translation). IMU Archives.

[259] Vinogradov's letter to Carleson of 6 January 1981. IMU Archives.

[260] *Proceedings of the International Congress of Mathematicians, August 16–24, 1983, Warszawa*, volume 1, editors, Zbigniew Ciesielski and Czesław Olech. PWN—Polish Scientific Publishers, Warszawa, North-Holland, Amsterdam, New York, Oxford, 1984.

[261] The Executive Committee had begun discussions about candidates for the next Executive Committee in the spring of 1981. Since Prohorov was not present, this happened without Soviet views being heard. I was told that I would be the candidate of the Executive Committee for Secretary. Such a proposal also came from the National Committees of the USA and U.K. In the conditions prevailing, I felt that the Secretary should be acceptable to the USSR as well. Carleson took advantage of the Moscow meeting to learn about the Soviet view. I have forgotten whether a positive statement was made by Vinogradov in plain language, but I remember that in no time our glasses were filled with Moldovian brandy. Vinogradov proposed a toast that Professor Lehto would well live for the next four years. After someone had interjected that "four" should be changed to "five" because the occasion was one year ahead of the Secretary's four-year period, the imperturbable Vinogradov granted me one more year.

[262] Mark Kramer, "Crises in Soviet–East European Relations, 1948–1981: Making Use of New Evidence." Paper prepared for the International Conference "New Developments in the History of the Cold War," Moscow, 12–15 January 1993. Kramer is of the opinion that Jaruzelski's position is bound to remain inconclusive until documents are obtained from the Presidential Archive specifying what the Politburo and Suslov's commission decided at their sessions in December 1981.

[263] Letter of 18 December 1981 from Willem Kuijk to L. Carleson. IMU Archives.

[264] Letter of 22 December 1981 from Lennart Carleson to Willem Kuijk. IMU Archives.

[265] Letter of 5 January 1982 from Czesław Olech to Lennart Carleson. IMU Archives.

[266] Letter of 29 January 1982 from F. Van Oystaeyen to J.-L. Lions. IMU Archives.

[267] Circular letter of 11 February 1982 from J.-L. Lions (and agreed upon by Carleson and Lehto) to all members of the Executive Committee. IMU Archives.

[268] Letter of 2 March 1982 from Maciej Nalecz, Deputy Scientific Secretary of the Polish Academy of Sciences, to L. Carleson. IMU Archives.

[269] Lennart Carleson, Notes from meetings with Professor Cz. Olech, 8–9 March 1982. IMU Archives.

[270] Letter of 24 February 1982 from Carlo Pucci to Jacques-Louis Lions with appendix. IMU Archives.

[271] Letter of 15 March 1982 from G.D. Mostow, Chairman, U.S. National Committee for Mathematics, to the Executive Committee, International Mathematical Union. IMU Archives.

[272] Letter of 16 April 1982 from Willem Kuijk to the President and Secretary of the International Mathematical Union. IMU Archives.

[273] *IMU—Bulletin of the International Mathematical Union*, no. 19, December 1982. The tape of the General Assembly and its typewritten versions, prepared by IMU's Office Secretary, Antoinette Theis, are in the IMU Archives.

[274] Schinzel's words were later misquoted and then corrected. The text in the revised edition of Donald J. Albers, G.L. Alexanderson, Constance Reid, *International Mathematical Congresses, an Illustrated History 1893–1986*, Springer-Verlag, New York, 1987, was from Olech and based on what Schinzel remembered having said. My text is from the tape recording. It is not in verbatim correspondence with the Olech–Schinzel version, but both have the same meaning.

[275] Motion adoptée en Assemblée Générale Extraordinaire de la Société Mathématique de France, le 16 octobre 1982. Appendix to the letter of 27 October 1982 from C. Houzel, President of the French Mathematical Society, to J.-L. Lions. IMU Archives.

[276] Letter of 20 October 1982 from G.D. Mostow to Lennart Carleson. IMU Archives.

[277] I have been able to check this and other of my reminiscences of the Polish episode from three articles that I wrote at the time for the Journal *Yliopisto* of the University of Helsinki. They were published (in Finnish) in March 1982, April 1982, and February 1983.

[278] G.D. Mostow, "The 1983 Warsaw Congress of IMU." *AMS Notices*, October 1983.

[279] Letter of 15 March 1985 from Academician S. Sobolev to Professor J. Moser, President of the IMU. IMU Archives. After the death of Vinogradov in 1983 at the age of 92, Sobolev had succeeded him as Chairman of the National Committee of Soviet Mathematicians.

[280] Letter of 13 May 1985 from G.D. Mostow to U.S. Committee for Mathematics. IMU Archives.

[281] Letter of 24 June 1985 from G.D. Mostow to Jürgen Moser. IMU Archives.

[282] Letter of 18 July 1985 from Lennart Carleson to G.D. Mostow. IMU Archives.

[283] *IMU—Bulletin of the International Mathematical Union*, no. 26, December 1986.

[284] Letter of 15 January 1975 from the Executive Secretary of ICSU to Secretaries General of International Unions... with Annex containing Resolution 6.51 of UNESCO, adopted at the forty-seventh plenary meeting on 23 November 1974, and an associated letter by Amadou-Mahtar M'Bow, Director-General of UNESCO. In his letter, Amadou-Mahtar M'Bow referred to two previous letters, dated 22 December 1972 and 14 November 1973, on the same subject. IMU Archives.

[285] Letter "China: Episode $(n + 1)$" of 30 May 1978 from Lions to the members of the Executive Committee. IMU Archives.

[286] Letter of 10 September 1978 from Chow Pei-Yuan, Acting Chairman of the Scientific and Technical Association of the People's Republic of China and Vice-President of Academia Sinica, to Sir John Kendrew, Secretary General of ICSU. IMU Archives.

[287] IUB Circular no. 128: 28 July 1979, by W.J. Whelan, to the Adhering Bodies of the ICSU Family. Application from the Chinese Biochemical Society for Membership in IUB, and the associated Press Report. IMU Archives.

[288] Letters of 13 and 19 November 1979 from Lions to Professor Hua Loo-keng, Academia Sinica, Beijing. IMU Archives.

[289] Letter of 24 March 1980 from Professor Kwan Chao-chih to Carleson. IMU Archives.

[290] Letter of 27 May 1980 from Lions to Professor Hua Loo-keng, Director, Mathematics Institute, Academia Sinica, Beijing. IMU Archives.

[291] Letter of 29 October 1981 from Lions to Lehto. IMU Archives. Lions puts the blame on a declaration made by Ronald Reagan during his presidential campaign in the fall of 1980. As explained in the text, the political difficulties actually started a few months earlier.

[292] Letter of 14 October 1980 from Professor Wang Shou-ren, Deputy Secretary General of the Chinese Mathematical Society, Deputy Director of the Institute of Applied Mathematics, Academia Sinica, Beijing, China, to Lions. IMU Archives.

[293] Letter of 31 October 1980 from Carleson to Lions. IMU Archives.

[294] International Council of Scientific Unions, Draft Resolution for General Assembly, approved by the Executive Board on 6 May 1982. IMU Archives.

[295] Resolutions and Decisions of the 19th General Assembly of ICSU. Robinson College, Cambridge, 13–17 September 1982. IMU Archives.

[296] Letter of 25 May 1982 from Lions (on behalf of Carleson also) to Professor Hua Loo-keng, President of the Chinese Mathematical Society, Beijing; Professor Wang, Secretary of the Chinese Mathematical Society; Beijing, and Dr. Fang-Jun, Deputy Director, Department of International Affairs of CAST, Beijing. IMU Archives.

[297] Report of the 45th Meeting of the Executive Committee of IMU. Paris, Collège de France, Room 4, November 13, 1982. IMU Archives.

[298] Lennart Carleson, Report on the "China-problem," April 1983. Similar in content was the report "Discussion with Professor Yang Lo on April 16, 1983" by Olli Lehto. IMU Archives.

[299] Letter of 11 May 1983 from Moser to the China Association for Science and Technology, Beijing. IMU Archives.

[300] Letter of 1 March 1884 from Wu Wen-tsün to J. Moser. IMU Archives.

[301] Letter of 14 May 1984 from Moser to Professor Wu Wen-tsün. IMU Archives.

[302] Letter of 17 June 1984 from Wu Wen-tsün to Jürgen Moser. IMU Archives.

[303] Letter of 19 October 1984 from Lehto to the members of the Executive Committee. IMU Archives. I had sent the same letter dated 3 October 1984 to President Moser for comments.

[304] Memorandum concerning the membership of China in the IMU. Accepted at the meeting of the IMU Executive Committee in Paris on 9–10 May 1985. IMU Archives.

[305] *International Council of Scientific Unions—Year Book 1995*, edited by Tish Bahmani Fard and Catherine Leonard. ICSU Secretariat, 51, Boulevard de Montmorency, 75016 Paris. The decision-making organs of ICSU are the General Assembly, the General Committee, and the Executive Board. The General Assembly, which consists of the representatives of the Union members and of the National members, is the highest authority of ICSU. After World War II, it met every second year until 1990, and after that every third year. The General Committee, which until 1996 met every year, consists of three groups of

members: First, the Officers of ICSU, i.e., the President, two Vice-Presidents, Secretary General, Treasurer, and Past President. Second, each of the twenty-three Unions has a representative to the Committee who is nominated by the Union. Third, there are twenty-three elected representatives of National members, whose term of office is six years. The Executive Board consists of the Officers and of Ordinary Members, three from the Union members and three from the National members, elected by the General Committee from its own membership. A permanent ICSU Secretariat is located in Paris, at the Hôtel de Noailles. In 1995 it had a staff of nine.

[306] *IMU—Bulletin of the International Mathematical Union*, Special Number, Eighth General Assembly, 1978, pp. 18–19. IMU Archives.

[307] The account of ICSU's nondiscrimination principle in the case of Japan is based on Komatsu's report "The ICSU General Assembly and the South African Problem" of November 1988 and on the letter of 24 February 1989 from Masao Ito to Komatsu. Both documents are in the IMU Archives.

[308] Letter of 8 May 1989 from Olli Lehto to Mrs. Julia Marton-Lefèvre, Executive Secretary of ICSU. IMU Archives.

[309] Letter of 16 June 1978 from H. Freudenthal to the President of the International Mathematical Union, Professor Deane Montgomery. IMU Archives.

[310] A.G. Howson, "Seventy Five Years of ICMI." *Educational Studies in Mathematics* 15 (1), February 1984, pp. 75–93. In pages 80–90, Howson describes the trends in mathematical education and the role of ICMI in the years following the 1952 General Assembly of the IMU.

[311] Meeting at Princeton, Thursday–Saturday, 18–20 February 1982. IMU Archives. This was a joint meeting of the ICMI Executive Committee and IMU's Past President Montgomery and Secretary Lions. According to the Memorandum, five of the ten members of the ICMI Executive Committee were absent, including Secretary Hilton.

[312] *ICMI—Bulletin of the International Commission on Mathematical Instruction*, no. 15, January 1984, pp. 17–20.

[313] *ICMI—Bulletin of the International Commission on Mathematical Instruction*, no. 20, June 1986, "ICMI and South Africa," pp. 9–17.

[314] *ICMI—Bulletin of the International Commission on Mathematical Instruction*, no. 29, December 1990. Kahane's "Farewell Message" (pp. 3–8) is a personal overview of the events of ICMI during 1983–1990.

[315] "Mathematics competitions, a stimulus for popularising mathematics," pp. 12–16, in [314].

[316] "ICMI Report on Mathematical Contests in Secondary Education," editor, Hans Freudenthal. *Educational Studies in Mathematics* 2 (1) July 1969, pp. 80–114. This is a comprehensive account of mathematical competitions going back to 1894. The attached bibliography contains 105 entries.

[317] The IMO Site Committee was set up at the proposal of the Finnish delegate Matti Lehtinen, a long-time IMO activist and presently a member of the IMO Advisory Board.

[318] *IMU—Bulletin of the International Mathematical Union,* Special Number, Eighth General Assembly, 1978, pp. 12–13.

[319] *IMU—Bulletin of the International Mathematical Union,* no. 30, October 1989, pp. 7–8.

[320] *IMU—Bulletin of the International Mathematical Union,* no. 14, October 1978, pp. 33–34.

[321] *IMU—Bulletin of the International Mathematical Union,* Special Number, Ninth General Assembly 1982, p. 15.

[322] *IMU—Bulletin of the International Mathematical Union,* no. 30, October 1989, p. 29.

[323] *IMU—Bulletin of the International Mathematical Union,* no. 19, December 1982, pp. 10–12.

[324] *IMU—Bulletin of the International Mathematical Union,* no. 25, Special Number, Tenth General Assembly 1986, p. 13.

[325] *IMU—Bulletin of the International Mathematical Union,* no. 31, Special Number, Eleventh General Assembly 1990, pp. 11–13.

[326] "Mathematics in Developing Countries." Procès verbal de la réunion informelle du 23 août 1983 à Varsovie (Pologne). IMU Archives.

[327] Letter of 6 October 1983 from H. Hogbe-Nlend, Président CDE/UMI, to Dr. Guidy Wandja. IMU Archives.

[328] Letter of 21 November 1984 from Olli Lehto to Dr. Guidy Wandja. IMU Archives.

[329] Letter of 6 November 1985 from A.O. Kuku to Olli Lehto. The letter was entitled "The Second Pan-African Congress of Mathematicians. Appeal to the International Community to help prevail on Professor Hogbe-Nlend." It contained an appendix, "Review of catalogue of events so far," also signed by A.O. Kuku. IMU Archives.

[330] Letters of 15 October and 18 November 1985 from Henri Hogbe-Nlend to Olli Lehto. IMU Archives.

[331] Letter of 22 November 1985 from Olli Lehto to A.O. Kuku. IMU Archives.

[332] African Mathematical Union. Meeting of the Executive Committee, 7–8 November 1985, Yaoundé, Cameroon. "Decision on the 1986 Panafrican Mathematical Congress." Signed by H. Hogbe-Nlend, President; R. Ohuche, Vice-President; Sekou Traore, Secretary; Haile Alemayehu, Member; and Owusu-Ansah, Member. IMU Archives.

[333] Letter of 6 November 1985 from Francis Cagnac to Professor Kuku. IMU Archives.

[334] Letter of 9 December 1985 from A.G. Howson to Professor J. Moser, President of IMU. IMU Archives.

[335] Letter of 11 April 1986 from A.O. Kuku, President, African Mathematical Union, to Olli Lehto, Secretary, International Mathematical Union. IMU Archives.

[336] Report of the meeting of Expert Mathematicians on UNESCO Programs. Nice, 19–20 June 1987. IMU Archives.

[337] I had visited South Africa in February–March 1991 and, having become convinced that apartheid no longer existed in the academic community, suggested in letters of 20 March and 12 April 1991 to A.O. Kuku that South African mathematicians be invited to the 1991 Pan-African Congress. IMU Archives.

[338] Letter of 16 February 1972 from Kenneth O. May, Chairman, Commission on the History of Mathematics, to Professor Otto Frostman, Secretary, International Mathematical Union. IMU Archives.

[339] Letter of 5 July 1972 from Otto Frostman to Dr. Kenneth O. May. IMU Archives.

[340] Letter of 25 May 1981 from Prof. Dr. C.J. Scriba to Prof. J.-L. Lions. IMU Archives.

[341] Report to the Division of History of the International Union of History and Philosophy of Science, July 1985, by Christoph J. Scriba, Chairman. IMU Archives.

[342] Letter of 25 July 1986 from C.J. Scriba to O. Lehto, Secretary, International Mathematical Union. IMU Archives.

[343] Letter of 5 February 1988 from Olli Lehto to Professor J.W. Dauben, Chairman, International Commission on the History of Mathematics. IMU Archives.

[344] Minutes of the meeting of the IMU Executive Committee, St. Catherine's College, Cambridge, April 6–7, 1990. IMU Archives.

[345] See [17]. Poincaré had been unable to attend the Congress but had sent the manuscript of his lecture, which was read by Professor Franel.

[346] In the 1820s, Jacobi commented on Fourier's *Théorie de la chaleur* as follows: *Il est vrai que Monsieur Fourier avait l'opinion que le but principal des mathématiques était l'utilité publique et l'éxplication des phénomènes naturels; mais un philosophe comme lui aurait dû savoir que le but unique de la science, c'est l'honneur de l'esprit humain, et que sous ce titre une question de nombre vaut autant qu'une question du système du monde.*

[347] Enrico Bompiani, Record of the Second General Assembly held on 31 August–1 September 1954 at the Hague (Binnenhof). IMU Archives. Published also in *Internationale Mathematische Nachrichten* 35/35, November 1954, "Union News," pp. 4–14.

[348] Letter of 14 January 1976 from W.T. Koiter, President of IUTAM, to Professor J.-L. Lions. IMU Archives.

[349] Letter of 25 February 1987 from Prof. K. Osterwalder, President of IAMP, to Academician, Prof. L.D. Faddeev. IMU Archives.

[350] Letter of 26 May 1987 from Olli Lehto to Professor K. Osterwalder. IMU Archives.

[351] Letter of August 1979 from Prof. Arto Salomaa, President of EATCS, and Prof. Thomas Ottmann, Secretary of EATCS, to Lennart Carleson, President of IMU, and J.-L. Lions, Secretary of IMU. IMU Archives.

[352] *IMU—Bulletin of the International Mathematical Union*, no. 19, December 1982, p. 38.

[353] *IMU—Bulletin of the International Mathematical Union*, no. 26, December 1986, pp. 11–12.

[354] *ICIAM '87: Proceedings of the First International Conference on Industrial and Applied Mathematics*, edited by James McKenna, AT&T Bell Laboratories, and Roger Temam, Université Paris-Sud. SIAM Philadelphia 1988.

[355] *IMU—Bulletin of the International Mathematical Union*, no. 23, June 1985, p. 4.

[356] *IMU—Bulletin of the International Mathematical Union*, no. 24, November 1985, p. 3.

[357] *IMU—Bulletin of the International Mathematical Union*, no. 25, Special Number, Tenth General Assembly 1986.

[358] *IMU—Bulletin of the International Mathematical Union*, no. 26, December 1986.

[359] At the opening session of the Berkeley Congress, Ahlfors was hailed as an American Fields medalist. Ahlfors, who moved permanently to the U.S. in 1946, had spent the academic year 1935–1936 at Harvard University. But when he received the Fields Medal in Oslo in 1936, he was a citizen of Finland, and the research for which he was awarded had been done in Finland and was greatly influenced by his teacher, Nevanlinna (cf. Carathéodory's presentation of the work of Ahlfors in Section 3.4).

[360] *Proceedings of the International Congress of Mathematicians 1986.* Edited by Andrew W. Gleason. American Mathematical Society, 1987.

[361] Donald J. Albers, G.L. Alexanderson, Constance Reid, *International Mathematical Congresses, an Illustrated History 1893–1986.* Springer-Verlag, New York, 1987. (It also happened that in the first printing the photographs of two Fields Medal winners were transposed.)

[362] After preliminary contacts with the IMU, Mizohata wrote on 28 September 1984 to the Union's President, Jürgen Moser, that the Japan Committee for ICM-90 had reached the conclusion to "try to invite ICM 90 to Japan." The document "Tentative Proposal for ICM 90 in Kyoto," dated 16 February 1985, which contained detailed information about Congress arrangements, was sent to the President and Secretary of the IMU with the request that it be discussed at the 1985 meeting of the Executive Committee.

[363] In the files of the IMU, the earliest recorded interest on the part of the Germans in the organization of the ICM-1990 is in June 1983 (a letter of Professor B. Pareigis to the IMU Secretariat). In March 1985, A. Dold, President of the German Mathematical Society, wrote to J. Moser, President of the IMU, that the Society was in favor of inviting the IMU to hold the ICM-90 in Munich. A formal invitation from Dold to the Secretary of the Union is dated 27 April 1985.

[364] Minutes of the 51st meeting of the Executive Committee of the IMU, 22–23 May 1987, Steklov Institute, Leningrad, USSR. IMU Archives.

[365] *IMU—Bulletin of the International Mathematical Union*, no. 31, Special Number, Eleventh General Assembly 1990.

[366] *IMU—Bulletin of the International Mathematical Union*, no. 32, November 1990.

[367] Note of 7 June 1990 by Nicolas H. Kuiper, Chairman, Program Committee ICM-Kyoto 1990, on Japanese and Soviet speakers. IMU Archives.

[368] *Proceedings of the International Congress of Mathematicians, 21–29 August 1990, Kyoto, Japan.* vol. I, edited by Ichiro Satake. The Mathematical Society of Japan. Springer-Verlag, 1991.

[369] *World Mathematical Year 2000.* Newsletter 1, Summer 1993. Institut Henri Poincaré, 11, rue Pierre & Marie Curie, 75231 Paris. By the end of 1996, four Newsletters advertising the World Mathematical Year 2000 had appeared.

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