The ICM through History

Guillermo Curbera (Sevilla, Spain)

It is Wednesday evening, 15th July 1936, and the City of Oslo is offering a dinner for the members of the *International Congress of Mathematicians* at the Bristol Hotel. Several speeches are delivered, starting with a representative from the municipality who greets the guests. The organizing committee has prepared speeches in different languages. In the name of the German speaking members of the congress, Erhard Schmidt from Berlin recalls the relation of the great Norwegian mathematicians Niels Henrik Abel and Sophus Lie with German universities. For the English speaking members of the congress, Luther P. Eisenhart from Princeton stresses that "*mathematics is international … it does not recognize national boundaries*", an idea, although clear to mathematicians through time, was subjected to questioning in that era. Lastly, the French mathematician, Gaston Julia, a professor at Sorbonne University in Paris, takes the stand as the French voice. After praising the country of Amundsen, Ibsen, and Grieg, he evokes a personal story:

"Twenty years ago, a young, wounded officer was taken after having surgery at night to a room. He was falling asleep when he was awakened by his own blood overflowing in his mouth: an artery had just reopened. He barely had time to cry for help before losing consciousness.

When he recovered consciousness he recognized by him the nurse in charge of the service. In absence of the surgeon, who had left the hospital, and of the night doctor, occupied elsewhere, at the moment without hesitating she stopped and cured the bleeding with security and determination, reanimating that fainting body. When the doctor was back he realized everything was well done and praised the decision and ability of the nurse.

On the fear of the accident occurring again, in a spontaneous and charitable gesture, that generous lady decided to stay all that difficult night by the wounded soldier. I will never forget that long night in which, almost unable to speak, broken by the bleeding, and unable to get sleep, I felt relieved by the presence of that woman who, sitting by my side, was sewing in silence under the discreet circle of light from the lamp, listening at regular intervals to my breathing, taking my pulse, and scrutinizing my eyes, which only by glancing could express my ardent gratitude.

Ladies and gentlemen. This generous woman, this strong woman, was a daughter of Norway."

Beyond the impressive intensity of the personal tribute contained in these words, the scene has a deep significance when interpreted within the history of the international cooperation in mathematics. Let us collect all the facts needed for proper understanding.

The day before, Tuesday 14th July 1936, the International Congress of Mathematicians (ICM) had been inaugurated. Four hundred and eighty seven mathematicians from thirty-six countries attended the congress. The inauguration ceremony took place in the Aula of the University of Oslo, in the presence of King Haakon VII of Norway. A well known photograph shows this moment, with the king seated in the corridor and several known mathematicians in the front rows. After the opening speeches and the election of Carl Størmer as President of the Congress, a new feature in ICM protocol was included: the first two Fields medals were awarded. Elie Cartan acting as President of the *Fields Commission* explained to the congress:

"*At the closing session on the 12th September 1932, the International Congress of Mathematicians of Zurich decided to accept the legacy of the regretted Professor Fields which allowed the awarding, at each international con-*

Gaston Julia (1893–1978)

Opening ceremony at the Aula of Oslo University, 1936

Presentation of the medals in Oslo, as reported by the press

gress, of two gold medals to two young mathematicians to be distinguished by particularly remarkable works. At the same time, a commission was named in charge of designating the two laureates by the Oslo Congress, and composed by Mr Birkhoff, Mr Carathéodory, Mr Cartan, Mr Severi, and Mr Tagaki. This commission was presided over by Mr Severi who, not having being able to attend the Oslo Congress, has asked me to replace him in the presidency. The commission has come to the agreement of designating Mr Lars Alhfors from the University of Helsinki and Mr Jesse Douglas from the Massachusetts Institute of Technology as the two first awardees of the Fields medals. Mr Carathéodory has agreed to report on the work of the two laureates; he will give reading to his report"

After the report by Carathéodory, Cartan presented the medals to the awardees. Douglas' medal was collected by Norbert Wiener in Douglas' name since, as explained in the proceedings of the congress, "*Mr Douglas was strained and was not able to receive himself the medal to him assigned*". (The precise cause of this lack of attendance is still one of the mysteries of the history of the ICMs and the Fields medals.)

The Oslo congress was the tenth in the series of ICMs. The series had begun in Zurich, where *der erste Internationale Mathematiker-Kongress* took place from the 9th to the 11th of September 1897. The first invitation letter had an impressive list of signatories, including Adolf Hurwitz, Felix Klein, Andrei Markoff, Hermann Minkowski, Gösta Mittag-Leffler and Henry Poincaré. The congress was a success both with its attendance and its scientific level. Two hundred and eight mathematicians attended, among them Émile Borel, Georg Cantor, Felix Hausdorff, Charles de la Vallée Poussin (who lectured *Sur la théorie des nombres premiers*), Ernst Lindelöf, Émile Picard and Vito Volterra. Four of them were the plenary speakers: Hurwitz from Switzerland, Klein from Germany, Giuseppe Peano from Italy and Poincaré from France (who eventually did not attend but whose lecture, *Sur les rapports de l'analyse pure et de la physique mathématique*, was read at the congress). A total of thirty-four lectures were delivered. It is worth noting the fine equilibrium of nationalities of the chosen plenary speakers. But there was also another success: the atmosphere of the congress. This is very well illustrated by the regulations that were approved. The first article established the objectives of the congress. The first two were:

a) *To promote personal relations between mathematicians of different countries.*
b) *To review, in reports and lectures, the current state of the different branches of mathematics and to provide the occasion to discuss issues of recognized importance.*

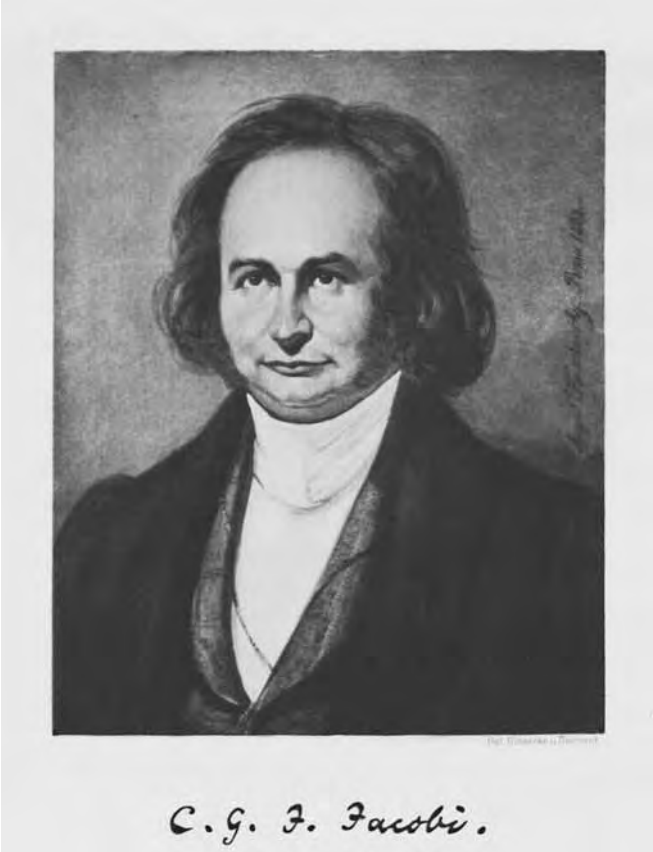
It is quite interesting to note the importance (for the development of mathematics) assigned to the role of personal relations between mathematicians.

From this congress comes the well known and beautifully coloured lithograph that was included in the proceedings, featuring five great Swiss mathematicians: Leonhard Euler, Daniel Bernoulli, Jakob Bernoulli, Johann Bernoulli and Jakob Steiner, and showing the Eidgenössiches Polytechnikum, a building that has hosted three ICMs.

Starting a tradition that was to occur for many congresses to come, at the closing session the offer presented by the Societé Mathématique de France for organizing the next congress was accepted. Thus, the *deuxième Congrès International des Mathematiciens* took place three years later in Paris. Charles Hermite was named honorary president, while the acting president was Poincaré. The four plenary speakers were Moritz Cantor (an historian of mathematics from Heildelberg), Poincaré, Mittag-Leffler from Sweden and Volterra from Italy. The celebrated lecture where David Hilbert presented his renowned list of twenty-three problems should have been a plenary lecture but, due to late submission, it was delivered in the Bibliography and History of Mathematics session and contained only ten of the problems. (When the proceedings were published, it was included among the plenary lectures with the title *Sur les problèmes futurs des Mathématiques* and contained all twenty-three problems.) At the closing session of the congress, Poincaré lectured *Sur le rôle de l'intuition et de la logique en la Mathématique* and Mittag-Leffler gave a tribute to his master, presenting *Une page de la vie de Weierstrass*.

At the invitation of the Deutscher Mathematiker-Verenigung, the city of Heidelberg hosted in 1904 *der dritte Internationale Mathematiker-Kongress*. Once again there were four plenary speakers: Alfred Greenhill from Great Britain, Paul Painlevé from France, Corrado Segre from Italy and Wilhem Wirtinger from the Austro-Hungarian Empire.

There is a legendary episode that occurred during this congress, caused by the lecture *Zum Kontinuum Problem*, by Jules König from Budapest, where it was claimed that Cantor's beloved conjecture was false. The section of the proceedings of the congress known as *Bericht über die Tätigkeit der Sektionen* (report on the activity of the ses-



Engraving of C. G. J. Jacobi, from the 1904 biography

sions) allows us to imagine the disturbance caused by the lecture. Indeed, it is explained that after the lecture there was a discussion in which Cantor, Hilbert and Schönflies participated. It is not written in the proceedings but that evening Felix Klein had to explain to the Grossherzog of Baden (who, together with Kaiser Wilhelm II, had covered the expenses of the congress) what could cause such unrest at a mathematical congress. Cantor's suffering was short; it is said that soon after Zermelo found the error in König's argument.

In this congress we find one of the classic features of older ICMs: a dedication for looking to the past of mathematics beyond the ever present section on the history of mathematics. The congress coincided with the centenary of the birth of Carl Gustav Jacob Jacobi. As a commemoration, the congress was opened with a biographical sketch of Jacobi given by Leo Königsberger from Heidelberg. The editor B. G. Teubner, who had also helped finance the congress, published a detailed biography of Jacobi by Königsberger and offered the book to the congress members at a third of its selling price. The dedication to Jacobi's commemoration even went so far as to inspire a discussion of the abandonment of Jacobi's grave in Berlin.

Carl Runge, from Munich, also looked back in history (and also forward!) when he lectured on the calculating machine designed by Leibniz in 1674. There was no way he could imagine the future development of calculating machines but with his lecture he initiated the presence of these devices at ICMs.

The congress also witnessed the presentation of the *Encyclopédie de sciences mathématiques*, a far reaching scientific project that was the expanded French version of the *Encyklopädie der mathematischen Wissenschaften*, which was first published in 1894.

Four years later, in 1908, the *IV Congresso Internazionale dei Matematici* took place in Rome. The organizing institutions were the great Italian scientific institution, the *Reale Accademia dei Lincei*, one of whose first members was Galileo Galilei, and the *Circolo Matematico di Palermo*. The congress was magnificent in its display: the inauguration was presided over by the king of Italy and took place in the Campidoglio beside the gorgeous frescos of the *Sala degli Orazi e Curiazo*; the Academia dei Lincei offered the lecture rooms of the Renaissance style Villa Farnesina by the Tiber river; and a reception was offered at the Philosopher's Room of Villa Adriana in Tivoli.

The increase in the size of the congress shows that the ICMs were gaining popularity. This time there were nine plenary lectures and five hundred and thirty five mathematicians attending. The scientific profile of the congress reflected the traditional tendency of Italian mathematics towards the study of physical phenomena: two of the plenary speakers were Antoon Hendrik Lorentz (who had received the Nobel Prize in Physics in 1902) and Simon Newcomb (the American astronomer); the congress was presided over by the Italian physicist Pietro Blaserna; and apart from the traditional sessions on arithmetic, algebra, analysis, geometry, history, philosophy and didactics, new sessions on mathematical physics and geodesy were added. Of all the lectures delivered, a particular highlight was *Grundlagen der Aritmetik und Analysis* by Ernst Zermelo.

A singular character of the Rome congress was the Italian mathematician Giovanni Guccia. In 1884 he founded the *Circolo Matematico di Palermo* and he was the person responsible for running and supporting the journal *Rendicontti del Circolo Matematico di Palermo*. Guccia supported the congress with two offerings: an award and the publication of the proceedings. The award, *the Medaglia Guccia*, was for a memoir on algebraic curves. The jury for assigning it comprised Corrado Segre, Max Noether and Poincaré, and they awarded the medal to Francesco Severi. Unfortunately, when Guccia passed away so did his fortune and the medal was never awarded again. Regarding the publications of the proceedings, a strike of Sicilian typographers prevented their publication in the *Rendicontti*; they were later published by the *Accademia dei Lincei*.

Still one of main countries in the history of mathematics had not organized an ICM. Thus, in 1912, the *V International Congress of Mathematicians* was held at the University of Cambridge. As had happened in Rome, the program of the congress also reflected the British tendency towards applications: the honorary president was Lord Rayleigh (who received the Nobel Prize in Physics in 1902), the president of the congress was George Darwin (astronomer and son of Charles Darwin) and new sessions were added on astronomy, economy, actu-

Giovanni Guccia, founder of the Circolo Matematico di Palermo

The Cambridge Scientific Instrument Company

arial sciences and statistics. Even the congress' scheduled visit had an applied flavour: the Cambridge Scientific Instrument Company, a leading company devoted to manufacturing high precision machinery. (In later times, this peculiarity of the ICM scientific program of reflecting the national trend of the mathematics of the host country was to disappear when the International Mathematical Union took over control of the program.)

Other features that had been seen at previous ICMs remained in the Cambridge congress. Looking to the past, members of the congress visited Mill Road Cemetery where a wreath was laid on Arthur Cayley's grave. Calculating machines also appeared; indeed, there was an exhibition at the Cavendish Laboratory of *books, models and machines (chiefly calculating machines)*.

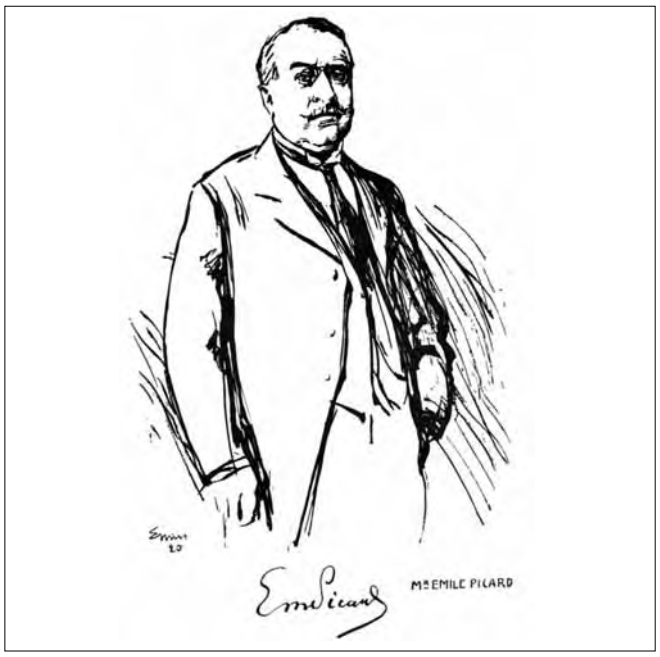
The Cambridge congress marked a high point in the History of the ICMs. Almost six hundred participants, coming from twenty-eight countries, seemed to assure a splendid future of international cooperation in mathematics. Four years before, at the Rome congress, cooperation in mathematical education had begun with the creation of the *Commission Internationale de l'Enseignement Mathématique* (originally presided over by Felix Klein). Even the idea of creating an international association of mathematicians was considered. It is remarkable that mathematicians could be so detached from the general atmosphere of increasing international tension.

The 1912 congress was closed with the invitation by Mittag-Leffler to host the 1916 ICM in Stockholm. The passion of Mittag-Leffler for his journal motivated this invitation to be issued in the name of the Swedish Academy and the journal *Acta Mathematica*. Two other invitations were presented: Budapest for the 1920 congress and Athens for the 1924 congress. The decisions on them were postponed until the Stockholm congress.

The Great War crushed this enthusiasm. The war and its aftermath had a tremendous impact on all aspects of social life, and science was not immune to it. In Brussels in 1919, the Allied Powers created the *International Research Council* (IRC) with the declared aim of promoting the creation of international scientific unions but whose scarcely hidden objective was to eliminate the preeminence that German science had in many fields. Many of the current scientific unions were then created, such as the International Union of Pure and Applied Physics (IUPAP), the International Union of Pure and Applied Chemistry (IUPAC) and the International Union for Astronomy (IUA). Well known mathematicians had a significant role in the IRC: Picard was the president until its dissolution in 1931 and Volterra was the vice-president.

Following IRC instructions, in 1920 the *Union Mathématique Internationale* (UMI) was created. The decision to celebrate the next ICM in Stockholm was overturned and an option more in tune with the Versailles Treaty was taken. The congress would to be held in Strasbourg, capital of the Alsace region, which had been regained by France after its loss to Germany in the Franco-Prussian war of 1870-71. This congress was the one with the least number of participants in the history of the ICMs. The reason was twofold. Firstly, an exclusion of mathematician from the former Central Powers (Germans, Austrians, Hungarians and Bulgarians) was imposed by the IRC and secondly, there was opposition from certain mathematicians, still a minority at that point, to this exclusion policy. The post-war tone of the congress as described in the proceedings is startling. There was a visit to the mausoleum of the Maréchal de Saxe, Genéral Taufflied lectured on *La Science en Alsace* and the ode *Salut à Straboug* was recited. There were also special regulations for the lunch of those congressmen who were reserve officers of the Allied Armies. The peak of this atmosphere came in the closing speech by Picard, who said, "*we assume the fine words of Cardinal Mercier during the war: to pardon certain crimes is to become accomplice with them*".

At Strasbourg it was decided to hold the next congress in New York in 1924. As the time got closer, it was clear that under the IRC exclusion policy it would not be possible to obtain the necessary support from the American mathematical community, which had long standing ties



A drawing of Émile Picard from the proceedings of the Strasbourg congress

Biberbach and Sierpinski on the steps of the ETH

with German mathematicians. At that moment, the continuity of the series of the ICM was seriously in danger. It was finally saved by the Canadian mathematician John Charles Fields who offered to organize the congress in Toronto. The congress, still with the absence of German, Austrian, Hungarian and Bulgarian mathematicians, was not able to avoid the influence of the war. The Belgian mathematician Charles de la Vallèe Poussin, President of the UMI, laid a wreath at the Soldier's Memorial Tower (the proceedings show a picture of the event) and in the opening session explained the meaning of the Strasbourg congress:

"What then mattered was not only a scientific congress but a symbol and a feast, the celebration of the liberation of Alsace and also, as I then said, the liberation of science from the sacrilegious hands that for so long had used it for their criminal aims."

When Salvatore Pincherle started to organize the 1928 ICM in Bologna, he was confronted with a serious dilemma; on the one hand there was insistence from the UMI and the IRC for the continuation of the exclusion policy and on the other hand there was a strong stand by several mathematical societies, such as the American Mathematical Society and the London Mathematical Society, and many individual mathematicians, who threatened not to attend if the congress was not truly international. The final outcome was that the congress was held not under the auspices of the UMI but those of the University of Bologna and was open to all mathematicians, regardless of their nationality. After two congresses in absence, German, Austrian, Hungarian and Bulgarian mathematicians could now attend. The entrance in the Aula Magna of the Archiginnasio of Bologna of Hilbert preceding the German delegation is legendary; the congress as a whole rose and applauded. Very few mathematicians represented so well as Hilbert the essence of the ICMs, that of being rooted in open international cooperation. Indeed, his plenary lecture *Probleme der Grundlegung der Mathematik* opened the congress.

The congress was an absolute success. Eight hundred and thirty-five mathematicians attended (of which Germans were the second largest national group) and the high number of communications can be easily judged by the size of the proceedings, which amounts to six large volumes. The congress retained some old traditions: two commemorative plaques were unveiled, one in the family house of Scipione dal Ferro and another in the church where Bonaventura Cavalieri was prior, and the book *Prefazione ai libri inediti dell' Algebra di Rafael Bombelli* by the historian of mathematics Ettore Bortolotti was presented at the congress and offered to the congress members.

The 1932 congress was held in Zurich again. After the turmoil of the previous ones, this was a sweet congress. The international mathematical community was reunited again and the deep dangers that were soon going to threaten the world had not yet risen. Two pictures display this pleasant atmosphere. One is the well know picture of Waclaw Sierpinski from Warsaw, chatting at the steps of the Eidgenössiche Technischen Hochshule with Ludwig Bieberbach from Berlin, who was later to become one of the promoters of the so called Deutsche Mathematik.

The other is related to the controversy on whether or not to consider the Strasbourg and Toronto congresses as true ICMs due to the restrictions they had on their attendance. The proceedings of the Bologna congress had labeled it as the sixth ICM, the one after the fifth of 1912 in Cambridge. At the opening ceremony in Zurich, Hermann Weyl said:

"We attend here to an extraordinary improbable event. For the number of n, corresponding to the just opened International Congress of Mathematicians, we have the inequality $7 \le n \le 9$; unfortunately our axiomatic foundations are not sufficient to give a more precise statement"

The consequence of this controversy was influential; the ICMs have not been numbered since.

Regarding the UMI, its statutes had expired in 1931 and at the Zurich congress the decision to dissolve the Union was taken. The strong feeling of mathematicians forming a united community had won against the intervention of the IRC. This situation is unique among the scientific unions. The UMI disappeared due to the abandonment of its members. (The re-foundation of the union after World War II is a different and happier story).

When Gaston Julia stood up at the Bristol Hotel in Oslo and referred to his war experience, he was speaking to mathematicians of different nationalities, many of whom had participated in the war and lived in its aftermath. He himself was a living example of the horrors of the war; he carried a mask partially covering his face for the rest of his life. But international cooperation in mathematics had survived the war and its aftermath.

This story illustrates the richness contained in the history of the ICMs, beyond its extraordinary mathematical content.

These and many other stories are told in the exhibition, *The ICM through History* (organized for the ICM-2006 in Madrid) which is a chronicle, based on graphical materials, of the ICM as a human endeavor. The exhibition is now the property of the Spanish mathematical societies and it is stored in the University of Sevilla. It has been conceived to be exhibited elsewhere. The institutions interested in exhibiting it should contact the author of this article.

The exhibition *The ICM through History* at the ICM-2006 in Madrid

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