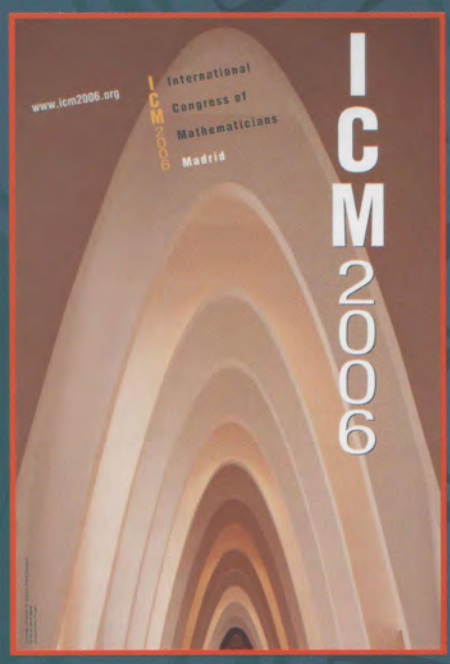
August 2006

SCM Notícies

Special issue on the occasion of the ICM 2006

- The Parliament of Catalonia supports the ICM 2006
- Mathematics in Catalonia: 1996–2002
- The Czech–Catalan venture: a fruitful collaboration



- Brief history of the SCM/Notícies

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Welcome

The International Congress of Mathematicians is without doubt the most important mathematical event in the world. Having the opportunity to organise an ICM is an unparalleled honor for a community of mathematicians. This honor has been bestowed to Spain in 2006.

The Catalan Mathematical Society (*Societat Catalana de Matemàtiques*, SCM) is proud to participate in the organisation of this Congress. The SCM president is one of the vicepresidents of the Executive Committee of the Congress, together with the president of RSME and former presidents of SEIO and SEMA. This privilege was agreed in 2002 as a recognition of the fact that the four societies RSME, SCM, SEIO and SEMA made up the Spanish IMU Committee when it was entrusted with the responsibility to organise the ICM 2006 by the General Assembly of IMU in Shanghai. At present, the Spanish IMU Committee encompasses seven societies, after the incorporation of FESPM, SEHCYT and SEIEM in 2004.

This special issue of the journal *SCM/Notícies* is dedicated to the ICM 2006 and has been designed as a homage to the Congress and as a demonstration of enthusiasm of the Catalan mathematical community. The collective response to the call for contributions to this issue has been rapid and generous. We are thus delighted to present Mathematics in Catalonia on the occasion of the ICM 2006.

This issue contains a presentation of several institutions that lead mathematical research and education in Catalonia. In addition, quantitative and qualitative information is given in the report entitled *Mathematics in Catalonia 1996–2002*, which was elaborated by the Institute for Catalan Studies and published as an article of the Institute's journal *Contributions to Science* in 2005. A brief summary of international cooperation is given, together with other aims and actions of the Catalan Mathematical Society. This offers altogether a substantial overview of the community's activity.

The institutions presented in this issue do not exhaust of course the list of centres where mathematical research, education or divulgation is made in Catalonia. Among the universities, only the three that award a degree in Mathematics are displayed here. A number of other universities exist in Catalonia, and all of them host active mathematicians. Moreover, if the scope of our survey is enlarged to the whole territory where the Catalan language is spoken and the Catalan culture is alive in its many forms, then the list of universities to be mentioned would be much longer. The reader is referred to the website of the *Institute Joan Lluís Vives* (http://www.vives.org), a network of 20 universities within the territories of Catalan culture, for complete information.

Besides the universities and the *Centre de Recerca Matemàtica* (CRM), other institutions work for Mathematics in Catalonia. In fact, a big effort is devoted to the promotion of Mathematics at schools. This task is undertaken by the SCM and also by several associations that are assembled together in the *Federació d'Entitats per a l'Ensenyament de les Matemàtiques a Catalunya* (FEEMCAT). The FEEMCAT shares some activities with the SCM, principally the ESTALMAT programme for the care of talent among mathematically gifted students aged 11 to 13, a successful initiative started by Miguel de Guzmán in 1998 in Madrid.

We certainly do not want to forget any institution deserving to be mentioned in this issue. There are many, since there are in fact many people who love Mathematics and work for its progress and divulgation. For this reason, we do not attempt to list all of them, and apologize here for any deficiency in emphasis that may have occurred.

The ICM 2006 is accompanied by a large number of satellite events (more than sixty). This is another demonstration of the importance of the Congress and its strong effect on the mathematical people and institutions, not only of Spain, but also of some of the surrounding countries. The benefit of this Congress has already been clearly perceived and is expected to become even more evident in the coming months and years.

Carles Casacuberta
SCM President

The SCM remarks that the opinions expressed and the comments made in the following pages belong solely to the authors of the corresponding articles and/or to the institutions they represent. The SCM does not necessarily share these opinions or comments.

The SCM wishes however to sincerely thank all the contributors to this special issue of *SCM/Notícies* for their prompt and effective response to the call for contributions. We apologise for the fact that, because of calendar constraints, the time given to authors for writing their contributions has been much less than the usual one. If, after all, the present issue is edited and printed is, doubtless, thanks to the effort of all of them.

Enric Ventura
Editor of *SCM/Notícies*

Catalonia and the ICM 2006

Presentation of the SCM

The Catalan Mathematical Society aims to promote all aspects of Mathematics in the territories where the Catalan language is official or normally used. It was established in 1931 as a section of the Society for the Promotion of Sciences, which had been created by the Institute for Catalan Studies (IEC). In 1986, the Society for the Promotion of Sciences split into three different societies, namely Chemistry, Mathematics, and Physics. Nowadays, the SCM is one of the 26 member societies of the IEC. With more than 1,000 individual members, most of whom are researchers or teachers at one or other level of the educational system, it is one of the most active, prestigious, dynamic and influential among the scientific and scholarly societies affiliated to the IEC.

The SCM is a member of the European Mathematical Society (EMS) since 1992. After a successful bid, it was entrusted by the EMS with organising the Third European Congress of Mathematics in Barcelona in July 2000. This was a major event, which gathered together more than 1,500 participants. The proceedings of this congress were published by Birkhäuser Verlag in the *Progress in Mathematics* series (volumes 201 and 202).

The SCM organises activities of many kinds, publishes books and journals, gives prizes, and represents the Catalan mathematical community before educational authorities and other institutions, both at home and abroad. Some of the courses and lectures organised by the SCM are aimed at researchers, while others are geared toward secondary school teachers or a general mathematical audience.

The SCM holds reciprocal agreements with several societies from outside Spain, including the American Mathematical Society, the Société Mathématique de France, and the Česká matematická společnost (Czech Mathematical Society). Several joint events have been organised with some of these institutions. In May 2005, the First Czech-Catalan Congress of Mathematics took place in Prague and gathered together more than 100 participants. The second event of this series will be held in September 2006 in Barcelona. In 2003, the SCM and the RSME jointly organised a two-day meeting on Cryptography in Barcelona. The Spanish societies RSME, SCM, SEIO and SEMA organised a major conference in Valencia in 2005, which served as an advertisement and a collaborative rehearsal for the ICM 2006.

The SCM awards an annual prize for students (the Évariste Galois prize), which is given to the author of the best research or essay on a mathematical topic, usually at a postgraduate level. The Institute for Catalan Studies also awards a biannual prize in Mathematics for the best PhD thesis written in Catalan (the Josep Teixidor prize) and an annual international prize (the Ferran Sunyer i Balaguer prize) for a mathematical monograph of an expository nature in English that presents the latest developments in an active area of research in

Mathematics in which the applicant has made important contributions. The prize, amounting to 12,000 euros, is financed by the Ferran Sunyer i Balaguer Foundation of the IEC. The winning monographs are published in the *Progress in Mathematics* series of Birkhäuser Verlag.

In 1996 the SCM took part for the first time in the annual contest of the international association *Le Kangourou sans Frontières*. This competition, called *Cangur* in Catalan, is aimed at students aged 14 to 18, and has become extremely popular in Catalonia, where the 10th anniversary of the event was happily celebrated in 2005. In 2006, close to 16,000 selected students from 487 centres of Catalonia, Valencia and Andorra have participated in the *Cangur* contest. The SCM organises other activities aimed at secondary school students, namely, an online problem competition awarding a prize to the centre whose team answers all the questions in a minimum time, and a literary contest offering a prize for the best written composition in Catalan with Mathematics as its theme.

A selection phase for the International Mathematical Olympiad takes place every year in December in Barcelona. Since 2003 the SCM is also responsible for the local organisation of the Olimpiada Iberoamericana Universitaria de Matemáticas.

The *Butlletí de la Societat Catalana de Matemàtiques* is a journal devoted to mathematical research and high-level expository articles written in Catalan. A volume consisting of two issues is printed every year. Since 1996 the SCM also publishes the newsletter *SCM/Notícies* and, following the launch in 2005, a new series of monographs entitled *Publicacions de la SCM* is now freely offered in electronic format. All volumes considered so far in this series are written in Catalan, although other languages are allowed.

Thus, the SCM shares the main goals of the Institute for Catalan Studies, namely, to promote scientific research, in particular research related to all aspects of Catalan culture, while furthering the development of society in general and, when necessary, acting as an advisor to the Catalan government and other institutions. In order to achieve this, and in addition to the main activities described above, the SCM organises yearly debates and lectures addressing different aspects of science and culture. On several occasions, SCM officers have led actions aimed at raising the profile of Mathematics among the general public, especially during the World Mathematical Year 2000. The interest of the SCM in launching wide-ranging actions is illustrated by several events, the most recent of which was a Joint Mathematical Weekend held with the European Mathematical Society in September 2005 in Barcelona.

For more information, see the SCM website http://scm.iec.cat.

Carles Casacuberta
SCM President

The Parliament of Catalonia supports the ICM 2006

In March 2006, the Commission of Culture of the Parliament of Catalonia adopted a resolution of support for the ICM 2006. The initiative that led to this resolution was started in July 2005 by Carme-Laura Gil, a former Catalan minister of Education and currently a member of the Commission of Culture of the Parliament. The chief officers of the Catalan Mathematical Society were called by the Commission, where they explained the aims and importance of the Congress and gave updated information about it. After this session, the following text was agreed by all political parties represented at the Parliament in November 2005.

In August 2006, Madrid will host the International Congress of Mathematicians (ICM), a quadrennial event that is the most important of all mathematical events held in the world since 1897. This is the first time that an ICM is organised in Spain. This honor and responsibility was awarded by the International Mathematical Union in 2002 to a committee formed by four mathematical societies, one of which is the Catalan Mathematical Society.

This is an excellent occasion to increase the influence of the Catalan mathematical community among Spanish scientists, while reinforcing its international prestige and its representation capability, thanks to the worldwide impact of the ICM. At the same time, this is an opportunity to make Mathematics more visible within the Catalan society and especially among the student population.

It is convenient and even necessary that the Catalan Government assumes these goals as proper in the framework of its scientific, educational and cultural policy, by programming and starting suitable actions on the occasion of this Congress.

On these grounds, the Parliament adopted the following resolution on March 1, 2006.

The Parliament of Catalonia asks the Government:

a) *To give institutional and financial support to the Catalan universities, research centres, the Catalan Mathematical Society and the FEEMCAT in order to make possible their joint participation at the ICM 2006 as national representatives of Catalonia.*

b) *To give institutional and financial support to the Catalan Mathematical Society, the FEEMCAT and the Catalan universities in order that they ellaborate jointly a programme of actions that, starting from the existing initiatives, leads to a further development of the mathematical capabilities of the students of Catalan educational centres and their interest for Mathematics and all sciences.*

c) *To give institutional support to the Catalan Mathematical Society in order to promote its presence at international entities.*

The recognition awarded to the ICM 2006 by such a high political body is emphasised and acknowledged. It is of course much deserved. On the more practical side, this support has made possible that the main mathematical centres and associations of Catalonia are jointly present at the ICM 2006 by sharing a booth and displaying information on their aims and activities.

The building of the Parliament of Catalonia

History of the Catalan Parliament

(Text retrieved and summarised from the Parliament's website.)

The Parliament of Catalonia has its roots in the distant past. These roots were the Assemblies of Peace and Truce and the Court of Counts. The Catalan Court of Counts was founded in the eleventh century in line with the French royal Curia, as the counts of Barcelona consolidated their position as reigning princes. It was made up of civil magnates and the clergy, high councilors and judges. The Assemblies of Peace and Truce were promoted by the church and taken on by the reigning power, the counts of Barcelona, with the aim of ensuring breaks in the continual private wars between feudal lords, establishing a system of guarantees and compensation for the clergy and civil population and also making agreements of a fiscal nature.

During the reign of James I the Conqueror (1213–1276), the Court of Counts became the General Courts of Catalonia, by gradually increasing the number of members invited and, above all, by consolidating the incorporation of the bourgeois state, represented by leading men from towns and cities. But the decisive step was taken during the reign of his son, Peter II the Great (1276–1285), when, at the Barcelona Courts of 1283, the system of negotiated rule

characteristic of Catalan medieval and modern constitutional law was established.

The Parliament of Catalonia

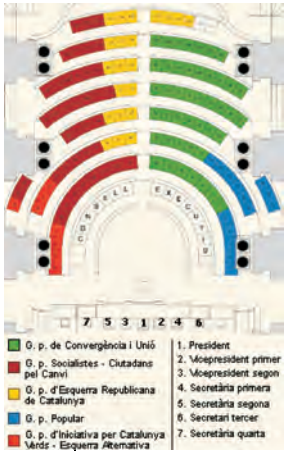
During the reign of Peter III the Ceremonious (1336–1387), the institution of the *Diputació del General* was created (the meeting of the Courts was called the *General de Catalunya*), with delegated powers to collect and administer the funding the Courts granted to the king. Gradually, the *Diputació del General* or *Generalitat* became more autonomous and accumulated executive and governmental powers, and by the sixteenth and seventeenth centuries it was acting as the government for the Principality.

The first monarch of the Bourbon dynasty in Spain, Philip V (1700–1746), respected the rights of the Catalan people by holding the Courts in 1701 and 1702. But, in the war of Succession, Catalonia opted to support the archduke Charles of Austria and recognized him as king. On losing the war and with the consequent fall of Barcelona in 1714, the victor abolished all public Catalan laws and the institutions representing it via the Decree of *Nova Planta* or New Proposition (1716), the most important of these institutions being the Courts.

Since that time, the Catalan people have aspired to recover their lost freedom. The *Mancomunitat de Catalunya* or Commonwealth of Catalonia from 1913 to 1925 was the first institutional step in recovering self-government. Once the Second Spanish Republic was proclaimed, a provisional Catalan government was set up in 1931, taking the name of the *Generalitat de Catalunya* in remembrance of the former institution. Chosen by the majority of the Catalan people, the Statute of Autonomy that definitively legitimized and structured Catalan self-government was approved by the Courts of the Republic in 1932.

The parliamentary tradition of Catalonia, interrupted in 1714, was therefore reinitiated. The first elections for the Parliament of Catalonia took place on November 20, 1932, and the constitutive sitting was held on December 6 of the same year. The first President of the Parliament was Lluís Companys.

Franco's dictatorship destroyed the hopes of the Catalan people for self-government for a long time (1939–1975). During the process of re-establishing democracy in the Spanish State, Catalonia was able to recover the *Generalitat*, provisionally, via the return of its President (1977), Josep Tarradellas, who had kept the institution alive in exile. Once the Spanish Constitution was approved in 1978 and the new Statute of the Autonomy of Catalonia was approved and endorsed in 1979, the *Generalitat* was re-established definitively. The first elections for the re-established Parliament of Catalonia took place on March 20, 1980, and the constitutive sitting was held on April 10 of the same year.



Room sessions of the Parliament

Five political parties are currently represented at the Parliament of Catalonia (Convergència i Unió, Socialistes - Ciutadans pel Canvi, Esquerra Republicana de Catalunya, Partit Popular, and Iniciativa per Catalunya Verds - Esquerra Alternativa), after the elections held in November 2003.

The Catalan Mathematical Community

This section gives a brief overview of Mathematics in Catalonia. Without intending to be exhaustive (and with apologies for any deficiencies in this regard) we provide a list of articles on the main Catalan institutions and organizations connected with the world of Mathematics. The first article is a reproduction of the report on mathematical research in Catalonia from 1996 to 2002 that was published last year in the journal *Contributions to Science* of the Institute for Catalan Studies. The reader will find a detailed qualitative and quantitative analysis of the state of mathematical research in Catalonia today.

The second article is about the *Centre de Recerca Matemàtica*, a prestigious research centre created in 1984, and the next one is about the *Ferran Sunyer i Balaguer* prize for mathematical research.

The next three articles are about the three Catalan universities that award degrees in Mathematics and have their own PhD programme in this field, namely the University of Barcelona, the Autonomous University of Barcelona and the Technical University of Catalonia. We point out that there are also other mathematicians pursuing active research who belong to other universities than the three discussed above. The following article is about the recently created ICREA, the body of high-level research scientists (mathematicians among them) supported by the Catalan government.

Finally, the last article is about FEEMCAT, one of the main Catalan organizations devoted to the teaching and training of students in Mathematics, and to the divulgation of Mathematical Education.

Mathematics in Catalonia: 1996–2002

Report published in *Contributions to Science* **3** (2005), no. 1, 103–110, Institut d'Estudis Catalans, Barcelona. An extended version of this report is available in Catalan on request to gguasp@mat.uab.es. [Reports de la recerca a Catalunya: Matemàtiques. Barcelona. Institut d'Estudis Catalans. 2004.]

Introduction

The aim of this article is to present the main conclusions of the report on research in Catalonia for the area of Mathematics. The report was published in 2005 by the Institute for Catalan Studies. This is a report of the scientific activity in Catalonia in the field of Mathematics during the period 1996–2002. It deals with two aspects of mathematical research. First, it provides an analysis of the country's research potential, as defined by its universities and other centers of investigation, their staff, as well as the economic resources that they obtain for research. Second, it offers an assessment of the scientific productivity of researchers from these institutions, as measured by analyzing, both quantitatively and qualitatively, articles published in specialized Mathematics journals and doctoral theses submitted to universities. The data from our study are often compared with those from the report on research in Mathematics corresponding to the period 1990–1996. A summary of that information and the conclusions drawn from that earlier report can be found in the article by Joan Girbau entitled Mathematics in Catalonia [*Contributions to Science* **2** (2001), no. 1, 111–121].

Universities and their human resources

In Catalonia, research in Mathematics is mostly carried out at universities. In this section, we provide quantitative information about mathematicians working at these institutions. However, only mathematicians working in Mathematics departments have been considered; thus, mathematicians that carry out their research in other departments, such as Economics and Computer Science, are not included in this study. However, their productivity is discussed in the data reported in the section entitled *Sci-*

entific productivity. Table 1 presents the figures concerning the staff at Catalan universities. The data correspond to the academic year 2001–2002, which is the last year of the period analyzed. During the period 1996–2002, there was an increase of 15 % in the number of teaching and research staff employed in the Mathematics departments of Catalan universities. This total increase, which was not uniform for all categories, shows that there has not been stagnation during this period; rather, the number of fellowship holders at the University of Barcelona, the Autonomous University of Barcelona, and the Technical University of Catalonia has increased significantly.

University	Permanent teaching staff	Term-contract teaching staff	Fellowship holders	Total
Autonomous University of Barcelona	55	48	10	113
University of Barcelona	79	30	15	124
University of Girona	14	9	2	25
University of Lleida	17	10	—	27
Technical University of Catalonia	193	79	22	294
University Pompeu Fabra	16	8	—	24
University Rovira i Virgili	14	—	3	17
Total	388	184	52	624

Table 1: Permanent teaching staff, term-contract teaching staff, and fellowship holders

Scientific productivity

Doctoral theses

Table 2 shows the number of doctoral theses on Mathematics submitted to Catalan universities between the academic year 1995–1996 and the academic year 2001–2002. There was a remarkable increase (ca. 37 %) in the number of theses submitted during the more recent period compared to the period 1990–1996. The increase in the number of fellowship holders (158 %) during this time most likely accounted for the increase in the number of theses. Despite this increase, the rate of theses supervised by permanent teaching staff was 0.45, which is markedly lower than during the period 1990–1996, indicating a decrease in productivity in relation to the potential of Catalan universities.

University	Theses
Autonomous University of Barcelona	32
University of Barcelona	46
University of Girona	1
University of Lleida	0
Technical University of Catalonia	78
University Pompeu Fabra	5
University Rovira Virgili	0
Total	162

Table 2: Doctoral theses submitted to each university during the period 1995–2002

Scientific publications

Scientific productivity in the field of Mathematics in Catalonia during the period 1996–2002 is analyzed from two points of view. First, the evolution of productivity of Catalan Mathematics is compared with that worldwide; second, productivity in Catalonia is compared with that of countries having the highest productivity in Mathematics. Catalan productivity is compared with worldwide productivity, first of all, by taking into account, for each year of the period analyzed (Table 3), all papers published in Mathematics. After this, the data are evaluated following the UNESCO codes (Table 4) for the classification of subfields in Mathematics. All the studies carried out include only work that was reviewed in the journal *Mathematical Reviews* during the period 1996–2002 and which have been published in journals, congress proceedings, or books. Note that, after a manuscript is sent for publication, it takes an average of 2-3 years for it to be listed in Mathematical Reviews. The papers that enter in the account of Catalan productivity are those having at least one author from a Catalan institution. Table 4 shows the distribution of papers published around the world and in Catalonia, in accordance with the UNESCO codes. The differences that can be seen between the totals in

Table 3 and those in Table 4, both in Catalonia and around the world, are due to the fact that many articles in Mathematical Reviews correspond to what could be called border fields in Mathematics, such as physics and economics, and thus have UNESCO codes different from those we have considered. The total number of publications during the period 1996–2002 in Catalonia is 2,584, compared to 472,633 worldwide. Catalan productivity in Mathematics represents 0.5 % of global production, a percentage higher than during the previous period (0.4 %). In addition, compared with the period 1990–1996, the number of publications in the world has increased by a factor of 1.28, while in Catalonia it has increased by a factor of 1.71.

1996	1997	1998	1999	2000	2001	2002	Total
Catalonia							
293	321	397	395	384	383	411	2,584
World							
63,064	66,590	67,886	70,025	70,217	69,170	65,681	472,633

Table 3: Total number of mathematical publications in Catalonia and around the world

Area and UNESCO code	World	%	Catalonia	%
Logic (1101–1104)	11,627	3.16	132	6.45
Algebra (1201)	34,374	9.34	149	7.28
Analysis (1202)	92,179	25.05	501	24.46
Computer Science (1203)	23,344	6.35	225	10.99
Geometry (1204)	32,285	8.78	176	8.59
Number Theory (1205)	14,505	3.94	58	2.83
Numerical Analysis (1206)	22,228	6.04	50	2.44
Operations Research (1207)	6,560	1.78	12	0.59
Probabilities (1208)	16,702	4.54	125	6.10
Statistics (1209)	23,100	6.28	87	4.25
Topology (1210)	15,553	4.23	65	3.17
Total	292,457	100.00	1,580	100.00

Table 4: Partial distribution of mathematical publications around the world and in Catalonia according to UNESCO codes

Analysis of the distribution according to classification of the works in the different fields, as defined by UNESCO codes, shows that the relative volume of Catalan production is comparable to that worldwide in all eleven areas considered, except Logic, Numerical Analysis, and Operations Research. In the Logic category, the percentage of Catalan productivity is almost twice as high as the global one, while in Numerical Analysis and Operations Research it is less than half of total global production. Productivity in Mathematics in Catalonia was compared with that in countries having the highest levels of productivity, defined as those countries with more than 2,000 publications reviewed in Mathematical Reviews during period 1996–2002. The list of Table 5 comprises 33 countries, almost all of them considered in the 1990–1996 study. Most of the countries with a high degree of development appears in this list. In Table 5, the 2002 population is given in millions of persons and the 2002 GDP in dollars per inhabitant. *Publications* is the sum of articles, proceedings and books. The data

from the 33 countries are sorted according to the figures for the column *Number of publications by million inhabitants*, i.e., from the highest to the lowest. An analysis of these figures (and those corresponding to the previous period) shows that mathematical production in Catalonia in 1996–2002 relative to population increased compared to the period 1990–1996 by a factor of 1.66. Note that Israel ranks first, far ahead of the other countries, while other mathematically productive countries, such as Japan or Russia, occupy lower positions. Catalonia ranks 15, which is the same position that it occupied during the previous period, and it has surpassed other countries, including the United States, Germany, the United Kingdom, and Italy. The relationship between GDP and publications by million inhabitants is heterogeneous. For some countries this relation tends to be linear. However, in the majority of countries, the number of articles per million inhabitants is higher than would be expected if the relationship was directly proportional.

Analysis of the quality of publications

In the previous section, we considered all articles on Mathematics published in Catalonia and worldwide, taking into account only the quantity, not the quality of these articles. We now turn our attention to the quality of the work produced. One indicator of the quality of a scientific article is its citation index, which is based on the number of citations by other authors over a given period of time. However, in our opinion, this index, which may be adequate for many scientific disciplines, should not be so good for Mathematics. We believe that there is no direct relationship between the quality and significance that an article may have for the development of Mathematics and its low term citation frequency. Thus, we have chosen to use an indirect measure of the quality of an article: the level of prestige of the journal in which it is published. Needless to say, any approach to measuring a journal's prestige can be objectionable, but our aim is to obtain data that allow comparisons with other countries to be established, rather simply reflecting the level of excellence of Catalan productivity in any field, and using as many approaches as possible.

We have defined *prestigious journals* as those with the highest impact factor among those with an index of persistence greater than 10 years. We then added to this group a limited number of specialized journals in particular areas to ensure that all areas were represented. The total number of articles published worldwide in the journals listed below (referred to as outstanding articles), over the period 1996–2002, amounts to 6.16 % of the total number of articles published in all journals reviewed in Mathematical Reviews over the same period.

List of prestigious journals:

- Acta Mathematica
- Advances in Applied Probability
- Advances in Mathematics
- American Journal of Mathematics
- Annales de l'Institut Fourier
- Annals of Mathematics
- Annales Scientifiques de l'École Normale Supérieure
- Archive for Rational Mechanics and Analysis
- Arkiv för Mathematik
- Artificial Intelligence
- Biometrika
- Bulletin of the American Mathematical Society
- Celestial Mechanics and Dynamical Astronomy
- Combinatorica
- Commentarii Mathematici Helvetici
- Communications on Pure and Applied Mathematics
- Duke Mathematical Journal
- Econometrica
- Ergodic Theory and Dynamical Systems
- Indiana University Mathematical Journal
- Inventiones Mathematicae
- Journal d'Analyse Mathématique
- Journal de Mathématiques Pures et Appliquées
- Journal für die Reine und Angewandte Mathematik
- Journal of Algebra
- Journal of Differential Equations
- Journal of Differential Geometry
- Journal of Functional Analysis
- Journal of Mathematical Analysis and Applications
- Journal of Mathematical Biology
- Journal of Number Theory
- Journal of the American Mathematical Society
- Journal of the American Statistical Association
- Journal of the Royal Statistical Society
- Mathematics of Computation
- Mathematische Annalen
- Mathematische Zeitschrift
- Nonlinearity

- Proceedings of the London Mathematical Society
- SIAM Journal on Applied Mathematics
- SIAM Journal on Control and Optimization
- SIAM Journal on Discrete Mathematics
- SIAM Journal on Numerical Analysis
- Studies in Applied Mathematics
- The Annals of Probability
- The Annals of Statistics
- Topology
- Transactions of the American Mathematical Society

	Country	2002 Population	2002 GDP	Art.	Publications	Publications/ Population
1	Israel	6	16,710	6,828	8,344	1,284.83
2	Switzerland	7	38,930	3,425	4,298	594.67
3	Canada	31	22,300	13,627	16,324	519.64
4	France	59	22,010	23,779	29,878	502.64
5	Singapore	4	20,690	1,863	2,072	497.60
6	Finland	5	23,510	2,004	2,516	483.94
7	Denmark	5	30,290	2003	2,572	478.67
8	Belgium	10	23,250	3,985	4,823	467.34
9	Austria	8	23,390	2,866	3,716	456.46
10	Sweden	9	24,820	3,246	4,024	450.92
11	The Netherlands	16	23,960	5,555	7,164	443.76
12	Australia	20	19,740	7,337	8,590	438.69
13	Czech Republic	10	5,560	3,404	4,224	413.72
14	Hungary	10	5,280	3,573	4,153	408.52
15	Catalonia	6	20,458	2,057	2,525	388.10
16	Germany	82	22,570	24,290	31,969	387.53
17	United Kingdom	59	25,250	18,668	22,715	385.93
18	Italy	58	18,960	18,365	21,920	378.46
19	USA	288	35,060	79,824	97,432	337.87
20	Spain*	34	16,475	9,195	11,158	327.79
21	Bulgaria	8	1,790	2,072	2,511	319.14
22	Greece	11	11,660	2,864	3,138	295.18
23	Poland	39	4,570	8,810	10,299	266.63
24	Rumania	22	1,850	5,238	5,943	265.85
25	Japan	127	33,550	22,902	26,251	206.47
26	Russia	144	2,140	22,211	25,764	178.83
27	Ukraine	49	770	6,697	7,632	156.66
28	Korea	48	9,930	6,189	6,555	137.59
29	Brazil	174	2,850	4,923	5,482	35.50
30	China	1,281	940	43,087	44,839	35.00
31	Turkey	70	2,500	2,202	2,348	33.54
32	Mexico	101	5,910	2,283	2,873	28.44
33	India	1,048	480	9,406	10,400	9.92

*Without Catalonia

Table 5: List of countries arranged by total mathematical production

On this basis, we have counted the number of outstanding articles published in any of the journals listed above by authors in the 33 countries listed in Table 5. The results are shown in Table 6, in which the countries have been sorted according to the ratio of number of outstanding articles by million inhabitants. In Table 7 the countries are sorted according to the percentage of articles published in the above list of prestigious journals compared with the total number of articles published.

	Country	Population	Outstanding articles	Outstanding articles/ Population
1	Israel	6	854	131.50
2	France	59	3,179	53.48
3	Switzerland	7	352	48.70
4	Canada	31	1,351	43.01
5	Denmark	5	222	41.32
6	Catalonia	6	254	39.04
7	Sweden	9	343	38.44
8	USA	288	11,020	38.21
9	Australia	20	679	34.68
10	United Kingdom	59	2,004	34.05
11	Finland	5	167	32.12
12	Singapore	4	133	31.94
13	Germany	82	2,584	31.32
14	Belgium	10	297	28.78
15	The Netherlands	16	456	28.25
16	Austria	8	225	27.64
17	Spain*	34	915	26.88
18	Italy	58	1,377	23.77
19	Hungary	10	213	20.95
20	Greece	11	215	20.22
21	Czech Republlic	10	172	16.85
22	Poland	39	440	11.39
23	Japan	127	1,396	10.98
24	Bulgaria	8	80	10.17
25	Rumania	22	169	7.68
26	Korea	48	328	6.83
27	Russia	144	489	3.40
28	Brazil	174	448	2.57
29	Ukraine	49	123	2.51
30	Mexico	101	135	1.34
31	China	1,281	1,613	1.26
32	Turkey	70	64	0.91
33	India	1,048	361	0.34

*Without Catalonia

Table 6: List of countries by number of outstanding articles

	Country	Outstanding articles/ total articles		Country	Outstanding articles/ total articles
1	USA	13.80	18	Italy	7.50
2	France	13.37	19	Belgium	7.45
3	Israel	12.50	20	Singapore	7.14
4	Catalonia	12.34	21	Japan	6.10
5	Denmark	11.08	22	Hungary	5.96
6	United Kingdom	10.73	23	Mexico	5.91
7	Germany	10.63	24	Korea	5.30
8	Sweden	10.57	25	Czech Republic	5.05
9	Switzerland	10.27	26	Poland	5.00
10	Spain*	9.95	27	Bulgaria	3.86
11	Canada	9.91	28	India	3.84
12	Australia	9.25	29	China	3.74
13	Brazil	9.10	30	Rumania	3.23
14	Finland	8.33	31	Turkey	2.91
15	The Netherlands	8.20	32	Russia	2.20
16	Austria	7.85	33	Ukraine	1.84
17	Greece	7.78			

*Without Catalonia

Table 7: List of countries ordered by outstanding articles/total articles (%)

	USA	ES	FR	UK	IT	DE	CA	NL	MX	AR	JP	CN	RU	BE	Cat
USA		692	2,281	2,507	1,642	2,812	2,739	846	235	148	1,039	1,773	893	470	221
Spain	692		337	260	282	211	116	101	96	93	39	77	150	216	214
France	2,281	337		532	916	884	496	200	89	49	269	167	606	256	136
UK	2,507	260	532		490	810	480	261	61	20	213	339	365	161	87
Italy	1,642	282	916	490		677	290	185	34	43	169	120	512	146	70
Germany	2,812	211	884	810	677		499	401	97	25	350	408	984	183	67
Canada	2,739	116	496	480	290	499		169	51	16	228	601	204	80	47
The Netherlands	846	101	200	261	185	401	169		5	7	84	78	116	143	33
Mexico	235	96	89	61	34	97	51	5		5	72	14	106	9	33
Argentina	148	93	49	20	43	25	16	7	5		3	1	1	9	33
Japan	1,039	39	269	213	169	350	228	84	72	3		371	193	47	30
China	1,773	77	167	339	120	408	601	78	14	1	371		64	54	27
Russia	893	150	606	365	512	984	204	116	106	1	193	64		62	27
Belgium	470	216	256	161	146	183	80	143	9	9	47	54	62		21
Catalonia	221	214	136	87	0	67	47	33	33	33	30	27	27	21	

Table 8: Number of articles written in collaboration

An analysis of the figures provided shows that 254 articles were published by Catalonia in prestigious journals during the period 1996–2002, indicating a 1.59-fold increase compared to the previous period. In the rest of the world, there was a 1.16-fold increase. For Catalonia, the *Number of outstanding articles by million inhabitants* ratio (Table 6) increased from 19.18 (1990–1996) to 39.04 (1996–2002), thus moving from the 14th place to the 6th place on the list. Note that this ratio may be influenced by the fact that the list of prestigious journals used in this study comprises a few more journals than the list used in the previous study (1990–1996). Catalonia has surpassed some European countries, including Germany, Sweden and the United Kingdom, which, like Catalonia, have not had large population changes. So, the rate of increase of outstanding articles in Catalonia was higher than in those three other countries. From the data shown in Table 7, it can be seen that Catalonia ranks quite high in the list, namely in the fourth place. The only surrounding European country that is ahead of Catalonia is France. For Catalonia, the *Outstanding articles/total articles* ratio increased by a factor of 1.22 compared to the previous period.

Analysis of the degree of collaboration in scientific publications

When analyzing the state of the art of mathematical research in Catalonia, we felt it was important to also consider both the number of articles written in collaboration with mathematicians from outside Catalonia and with which countries this kind of collaboration most frequently occurred. The results of this type of analysis may be interpreted in several ways. Some readers may think that collaborating with foreign colleagues means that the capabilities of Catalan mathematicians are limited and help is needed from outside sources. Alternatively, a high collaboration index can be viewed as corresponding to a high level of mathematical capabilities, which allows interactions in various Mathematics-related subjects and with different research groups from around the world. Regardless of the interpretation and subsequent conclusion, analysis of the degree of collaboration provides further insight into the state of mathematical research in Catalonia. Table 8 lists the 15 countries that collaborated most frequently with Catalonia in publishing Mathematics articles. The data reflect the degree of collaboration between the countries in absolute numbers. Most of the collaborations were with mathematicians in the United States, Canada, and European countries close to Catalonia. Nonetheless, Catalan mathematicians collaborated more often with colleagues in Mexico, Argentina, Japan or China than with those in countries such as Belgium or Scandinavia.

Funding and infrastructure

In analyzing the sources that fund mathematical research, the cost of maintaining infrastructure, including buildings, libraries, computer equipment, and lecture rooms, should be taken into account. There are also personnel costs, that is, the salaries of everyone working in mathematical research at any institution in Catalonia. Besides this, direct grants for research, which fund many research groups, finance research projects, the organisation of congresses, fellowships for visiting foreign researchers, scholarships for training researchers, etc. In the following, we refer mostly to direct grants for research and less frequently to bibliographic support and computer equipment. There are essentially three sources of subsidies for Catalan mathematical research: the Catalan Government, the Spanish Government, and the European Union. Table 9 summarizes the funding by theses three sources during the period 1996–2002. The Catalan Government has established several diverse programmes to fund research groups, projects, and individual researchers. Among these programmes, the one set up to fund *consolidated research groups* in Catalonia stands out since it aims to strengthen research groups by requiring that projects be cofunded by the group. At the end of the period 1996–2002, there were 18 consolidated groups in Mathematics in Catalonia, comprising 263 researchers from Catalan universities, a number that represents 60 % of the potential mathematical researchers in Catalonia. These groups received a total amount of 1,089.567 Euros during that time. The programme of the Spanish Government that provides much funding for mathematical research is the *Sectorial programme to promote general knowledge*. While a few Spanish programmes fund research in

areas that we considered to be related, they have little impact on funding in the field of Mathematics itself. Only a few of these programmes, such as the *Telematic Services and Applications* and Space Research, finance work in Mathematics, and most of the funding is indirect. Even though Mathematics is not a priority for the European Union, there are several programmes that support research. These have been funded by the European Union with the goal of creating thematic networks that facilitate researcher mobility and aid in the organisation of courses and congresses. In Catalonia, during the period 1996–2002, research projects centered around Mathematics received more than 10 million Euros. Regarding the sources of funding, only 13.8 % came from the Catalan Government. The main source of funding is the Spanish Government, with 49.5 %, followed by the European Union with 36.7 %. Comparing these figures with those from the period 1990–1996, there was an increase of 4 % in the funds from the Catalan Government, and a decrease of 5 % in the funding received from Spanish Government, while the European Union's funding remained at the same level. Funding provided for Mathematics libraries is another area of consideration. The investment three libraries of this type in Catalonia: at the faculties of Mathematics at the University of Barcelona (UB) and the Technical University of Catalonia (UPC), and at the Department of Mathematics at the Autonomous University of Barcelona (UAB). The investment in books and journals at the Mathematics library of the University of Barcelona during the period 1996–2002 amounted to 1,213,700 Euros. At the Department of Mathematics at the Autonomous University of Barcelona, 498,942 Euros were invested, while at the Statistics and Mathematics Faculty of the Technical University of Catalonia this investment was 286,244 Euros. Comparing these figures with those from the previous period, investments in books and journals at Catalan universities from 1996 to 2002 markedly increased. Nonetheless, both at the University of Barcelona and the Autonomous University of Barcelona, the number of journal subscriptions decreased. The Technical University of Catalonia doubled its outlay for books and started investing in journals. The total investment in Catalonia in bibliographic material related to Mathematics during the period 1996–2002 was almost 2 million Euros, an increase of more than 40 % compared with the previous period. This amount was less than 20 % of the total direct financial help received by research groups. Together with books and journals, computer resources are among the most important forms of support required by researchers in Mathematics. Without entering into a lengthy description of the types of computer equipment found in Catalan universities and other research centers, the equipment of the Dynamics Systems Group of the UB and UPC, which includes a HIDRA parallel computer (Beowulf computer) that provides service to a large number of users, should nonetheless be mentioned.

	1996	1997	1998	1999	2000	2001	2002	Total
Catalan Government	223,641	330,166	476,607	394,258	596,485	890,247	561,403	3,472,808
Spanish Ministry	493,974	607,851	377,927	614,377	801,832	952,552	1,366,702	5,215,215
European Union	851,495	419,661	385,726	342,062	589,333	529,365	823,216	3,940,858

Table 9: Funding

Other centers and institutions involved in mathematical research

As noted above, mathematical research in Catalonia is carried out essentially at universities, but there are other research centers that either do research in Mathematics or are involved in Mathematics-related collaborations in Catalonia. In this section, we will briefly describe these centers and institutions.

Centre de Recerca Matemàtica (CRM). The CRM is a consortium between the Catalan Government and the Institute for Catalan Studies that invites distinguished mathematicians from around the world to spend time as visiting researchers. It sponsors research programmes and organises thematic semesters, congresses, and

seminars. The activities of the CRM are carried out in coordination with research groups from Catalan universities.

Mathematics Institute of the University of Barcelona (IMUB). The IMUB is a research center linked to the University of Barcelona that is dedicated to research and basic training in all the fields of pure and applied Mathematics. It develops and supports research in Mathematics, including the organisation of scientific activities such as advanced courses, workshops, conferences, and seminars.

Institute of Research on Artificial Intelligence (IIIA). The IIIA is a center of the Spanish Scientific Research Council, located at the campus of the Autonomous University of Barcelona. Some of its scientific activity is directly devoted to Mathematics but it is also involved with Information Technology, which also has an important mathematical component.

Catalan Mathematical Society (SCM). The SCM is a subsidiary of the Institute for Catalan Studies that promotes both theoretical and applied research in Mathematics. It acts as a meeting point between mathematicians from the various Catalan universities and those working as Mathematics teachers in high schools.

Institute of Spatial Studies of Catalonia (IEEC). The IEEC is a private foundation that promotes activities, studies, and projects related to scientific research and space technology.

Statistics Institute of Catalonia (IDESCAT). The IDESCAT belongs to the Ministry of Economics and Finance of the Autonomous Government of Catalonia. Its objective is to promote research and development in the field of statistics.

Ferran Sunyer i Balaguer Foundation. This is a private foundation, sponsored by the Institute for Catalan Studies, that grants an annual award bearing the name of the Catalan mathematician Ferran Sunyer i Balaguer. The award is given to a monograph on recent developments in any field of Mathematics.

Edition of scientific publications

One of Catalonia's contributions to the development of Mathematics is the publication of several periodical journals of Mathematics. For the period 1996–2002, these publications included:

Collectanea Mathematica. This is the oldest Catalan mathematical journal. Its publication, by the University of Barcelona, began in 1948. The journal is exchanged by the Mathematical Library of the University of Barcelona with several international journals.

Publicacions Matemàtiques. Published by the Department of Mathematics of the Autonomous University of Barcelona. Its publication began in 1976 and it has been in the ISI databases since 2002.

SORT. It is published by IDESCAT, sponsored by the University of Barcelona and the Technical University of Catalonia. Since 2003 its name is *Statistics and Operations Research Transactions*.

Mathware & Soft Computing. This journal was created in 1994 and is published by the Mathematics and Computing Section of the School of Architecture of Barcelona, which publishes works in the fields of cognitive science and artificial intelligence.

Butlletí de la Societat Catalana de Matemàtiques. This journal publishes, in Catalan, articles in any field of Mathematics that may be of interest to a large number of readers.

Qualitative Theory of Dynamical Systems. The University of Lleida has published this journal since 2000. It consists of articles concerning the theory, methods, and applications of dynamical systems.

Advanced Courses in Mathematics CRM Barcelona. The CRM, by means of an agreement with the Birkhäuser publishing house, produces a collection of books based on the contents of the advanced courses organised by the CRM.

Publications of the CIMNE. The International Center of Numerical Methods in Engineering, which is a consortium between the Catalan Government and the Technical University of Catalonia, publishes *Archives of Computational Methods in Engineering* and *Revista Internacional de Métodos Numéricos para Cálculo y Diseño en Ingeniería*.

Conclusions

1. Among the universities with Mathematics programmes, permanent teaching staff increased only at the Autonomous University of Barcelona, wich previously had the lowest rate of permanent teaching staff.
2. The number of permanent teaching staff has stabilized. While this can have a positive effect on research dynamics, there is also a negative effect on the incorporation of young researchers. New professional paths for mathematicians through connections between university and the industrial and business worlds should be developed.
3. The number of fellowship holders at the three universities with Mathematics programmes significantly increased compared with the previous period. This probably resulted in an increase in the number of doctoral theses in Catalonia. The number of doctoral theses submitted by visiting students also increased. However, the total number of theses submitted was low when compared with the scientific potential of Catalan universities.
4. An analysis of mathematical productivity according to country showed that, in mathematical research, Catalonia maintained or improved its position among the most advanced countries. It should be noted, however, that the most rapid increase in productivity occurred up until the mid 1990s. The numbers seem to point out that a steady state was subsequently reached and that mathematical research in Catalonia has now entered a period of maturity.
5. The most productive fields in Mathematics around the world are also highly productive in Catalonia, except for Numerical Analysis and Partial Differential Equations, which need to be strongly promoted in the future.
6. The number of outstanding publications in relation to the size of the population in Catalonia and the country's position compared with surrounding European countries increased over the previous period.
7. Catalan mathematicians frequently collaborated with mathematicians from other countries. More than 40 % of the mathematical publications in Catalonia included authors from other countries, especially from the United States and surrounding European countries.
8. Catalonia should have more weight in the administration of resources dedicated to research. In the line to assisting research groups according to the quality of their productivity, the resources available for mathematical research should be increased, thereby promoting both scientific and technologic development. Catalonia has the appropriate conditions for making a qualitatively important advance in mathematical research, provided that it receives the necessary financial support.
9. Although investments in Mathematics libraries at Catalan universities increased in absolute numbers, the amount devoted to journals subscriptions remains insufficient due to large increases in subscription costs.
10. Despite the high level of mathematical research in Catalonia, its international recognition remains low. This may be probably due to the lack of a mathematical tradition. It is necessary to increase the presence of Catalan mathematicians on the committees of outstanding journals and in the decision-making groups of international institutions that formulate scientific policies. A major step to raise the prestige of Catalan Mathematics would most certainly be to increase the quality of Catalan mathematical journals to the level of outstanding journals.

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The Centre de Recerca Matemàtica, Barcelona

Institutional framework

The Centre de Recerca Matemàtica (CRM), the only Mathematics research institute in Spain, was created in 1984 as a personal initiative of Manuel Castellet by the *Institut d'Estudis Catalans* (Institute for Catalan Studies), an academic, scientific and cultural body whose aim is to promote research in science, technology and humanities, while supporting all aspects of Catalan culture. In this year 1984, precisely when the CRM was born, Peter Hilton wrote in The Mathematical Intelligencer: "A research institute is at least two things at the same time: it is a building and it is an organisation of people working together and dedicated to the pursuit and support of research. But at its best it is more. It starts life as an idea in the mind of one person —or, rarely, of persons— of insight and imagination, and then lives and grows by spreading the spirit, imbued by their founders, through the hearts and minds of all those benefiting from its presence and at the same time contributing to its future".

Since 2002, the CRM is a consortium, with its own legal status, integrated by the *Institut d'Estudis Catalans* and the Catalan Government. It is a research institute associated with the Autonomous University of Barcelona (UAB) and located on the Bellaterra campus, about 15 km from Barcelona.

The Governing Board of the CRM is chaired by the Minister of Universities, Research and the Information Society of the Catalan Government, and has eight members. In 2002, the Governing Board re-elected Manuel Castellet as Director, who is assisted by Carles Casacuberta and Jordi Quer as Associate Directors. A Scientific Advisory Board meets three times per year to advise the Directorate Team.

Aims and scope

The CRM gives support to local research groups in all areas of Mathematics and fosters emerging research directions, by inviting outstanding mathematicians and organising specialised research programmes, conferences, workshops, and advanced courses.

Since 1989 it hosts post-doctoral fellows (11 in 2005), including several Marie Curie grant holders, and it also hosts doctoral students as a Marie Curie Training Site of the European Union from 2000 to 2004. The CRM has been a node of three different European Community Research Training Networks entitled "Elliptic Cohomology" (1994-1996), "Homotopy Theory and its Applications" (1995-1997) and "Modern Homotopy Theory" (2000-2003), jointly with teams in Aarhus, Aberdeen, Bonn, Cambridge, Glasgow, Lille, Louvain-la-Neuve, Milano, Paris and Sheffield.

Research programmes

The Governing Board of the CRM approved in 2002 a quadrennial plan that includes two research programmes every year, together with complementary activities. Each research programme offers the following positions during one academic year: one full-time local researcher, one full-time visiting researcher, two post-doctoral fellows, and 24 months of visiting researchers for periods of one to three months. Activities include a weekly seminar, a conference or a workshop and an advanced course at a doctoral or post-doctoral level. Partial funding for visitors and activities is provided by the Department of Universities, Research and the Information Society (DURSI) of the Catalan Government, under a contract programme that is revised every year, and by means of competitive calls. Other sources of funding through competitive applications are the Spanish Ministry of Education and Science and the European Commission.

An open call for research programmes is made every year. Each programme has to be ap-

proved by the CRM Governing Board. Proposals are presented by the Director on the grounds of evaluation reports prepared by the Scientific Advisory Board.

CRM Research Programmes

2003–2004 – Set Theory
2004–2005 – Geometry of the Word Problem
2005–2006 – Arakelov Geometry and Shimura Varieties
– On Hilbert's 16th Problem
2006–2007 – Enumerative Combinatorics and Random Structures
– Discrete and Continuous Methods in Ring Theory
2007–2008 – Homotopy Theory and Higher Categories
– Geometric Flows. Equivariant Problems in Symplectic Geometry

Recent CRM Research Thematic Quarters

2004-2005 – Control, Geometry and Engineering
– Contemporary Cryptology
2005-2006 – Fourier Analysis and Geometric Measure Theory
2006-2007 – Non-Smooth Complex Systems
– Group-Based Cryptography

Scientific meetings

In 1986 the CRM started the organisation of conferences (29 ever since) and workshops (25) and in 1995 a prestigious series of advanced courses (27). Amongst the conferences we should point out the series "Barcelona Conference on Algebraic Topology" (BCAT), organised in 1986, 1990, 1994, 1998 and 2002, and "Barcelona Logic Meeting" (BLM), organised in 1994, 1995, 1997, 1998, 1999 and 2000, two reference points in these fields.

Recent CRM Conferences, Workshops and Advanced Courses

2004 – Advanced Course on Ramsey Methods in Analysis
– Workshop on the Foundations of Set Theory
– Advanced Course on Contemporary Cryptology
– Conference on Mathematical Foundations of Learning Theory
– Workshop on Non-Linear Differential Galois Theory
– Advanced Course on Automata Groups
– HYKE Conference on Complex Flows
2005 – 4th Congress of the European Society for Research in Mathematics Education
– Barcelona Conference on Geometric Group Theory
– Workshop on Mathematical Problems and Techniques in Cryptology
– Advanced Course on the Geometry of the Word Problem for Finitely Generated Groups
– Advanced Course on Recent Trends on Combinatorics in the Mathematical Context
– Advanced Course on Shimura Varieties
– Workshop on Graphs, Morphisms and Applications
– 2nd Workshop on Tutte Polynomials and Applications
2006 – Advanced Course on Arakelov Geometry and Shimura Varieties
– Barcelona Conference on Planar Vector Fields
– Workshop on Fourier Analysis, Geometric Measure Theory and Applications
– Advanced Course on Limit Cycles of Differential Equations
– Advanced Course on Combinatorial and Computational Geometry Trends and Topics for the Future
– Conference on Mathematical Neuroscience
2007 – Advanced Course on Analytic and Probabilistic Techniques in Combinatorics
– Advanced Course on Quasideterminants and Noncommutative Symmetric Polynomials
– Conference on Cryptography and Digital Content Security
– Advanced Course on Group-Based Cryptography
– Barcelona Conference on C^*-Algebras and their Invariants
– Conference on Enumeration and Probabilistic Methods in Combinatorics
– 2007 Barcelona Conference on Asymptotic Statistics

Around the International Congress of Mathematicians (ICM 2006) in Madrid, the CRM organises a three months research programme on "Fourier Analysis" and an advanced course on "Combinatorial and Computational Geometry", both co-ordinated jointly by researchers from Barcelona and Madrid, and a conference on "Mathematical Neuroscience", the last two activities as ICM satellite conferences.

Links with European entities

Since 2003, the CRM is an institutional member of the European Mathematical Society (EMS). It is also a foundational member of ERCOM (European Research Centres on Mathematics), a committee of EMS consisting of scientific directors of European research centres in Mathematics. In fact the current CRM Director, Manuel Castellet, has been the Chairman of ERCOM from January 2002 to December 2005.

As done by other ERCOM centres, the CRM undertakes actions to reinforce the role of Mathematics in the thematic priority areas of the 6th Framework Programme of the European Commission. Funding is offered to young mathematicians in order to foster the development of the following topics, which were selected on the basis of reports prepared by local teams: Life sciences, genomics, and biotechnology for health; nanotechnologies and nanosciences; information society technologies; sustainable development, global change and ecosystems. Several activities, including doctoral training and workshops, are planned on neuroscience and cryptology for the years 2004, 2005 and 2006.

In December 2005, a project entitled "Shaping New Directions in Mathematics for Science and Society" (MATHFSS) started as one of the Support Actions that were approved in 2005 within the NEST (New and Emerging Science and Technology) programme of the European Commission. It will last two years and has been possible by the collaboration of the following ERCOM centres: Centre de Recerca Matemàtica (CRM), project coordinator; Emmy Noether Research Institute for Mathematics (ENI), Israel; European Institute for Statistics, Probability and Operations Research (EURANDOM), The Netherlands; and Institut des Hautes Études Scientifiques (IHÉS), France. The goal of the project is to foster international contacts and draw training contents in Mathematics around the following emerging research topics: Systems Biology, Risk Assessment, Mathematical Neuroscience, Digital Content Security.

The CRM is a member of the EPDI (European Post-Doctoral Institute for the Mathematical Sciences), a network of nine European research institutes which jointly offer post-doctoral fellowships in Mathematics and mathematical physics every year.

Publications

Besides its twenty-year old preprint collection, the CRM publishes since 2001 a monograph series entitled Advanced Courses in Mathematics CRM Barcelona, which is produced and distributed by Birkhäuser Verlag (Basel). The series is especially addressed to doctoral and post-doctoral students. Volumes contain carefully edited notes written by lecturers at CRM advanced courses. The following nine volumes has been published:

- *Homotopy Theoretic Methods in Group Cohomology*, by W. Dwyer and H.-W. Henn (2001).
- *Lectures on Algebraic Quantum Groups*, by K. Brown and K. Goodearl (2002).
- *Symplectic Geometry and Integrable Hamiltonian Systems*, by M. Audin, A. Cannas da Silva and E. Lerman (2003).
- *Global Riemannian Geometry: Curvature and Topology*, by S. Markvorsen and M. Min-Oo (2003).
- *Proper Group Actions and the Baum-Connes Conjecture*, by G. Mislin and A. Valette (2003).
- *Polynomial Identity Rings*, by V. Drensky and E. Formanek (2004).
- *Kolmogorov Equations for Stochastic PDE*, by G. Da Prato (2004).
- *Ramsey Methods in Analysis*, by S. A. Argyros and S. Todorcevic (2005).
- *Contemporary Cryptology*, by D. Catalano, R. Cramer, I. Damgård, G. Di Crescenzo, D. Pointcheval and T. Takagi (2005).

– *String Topology and Cyclic Homology*, by L. Cohen, K. Hess and A. A. Voronov (2006).

Two more volumes are in preparation: *Automata Groups*, by R. I. Grigorchuk, and *The Geometry of the Word Problem*, by N. Brady, T. R. Riley and H. Short.

Facilities and infrastructure

The CRM occupies 1,300 square metres in the Science Building of the UAB. Office space allows to allocate up to 28 guests. Two lecture rooms are used for seminars and meetings. All offices and rooms are fully equipped and air conditioned. The CRM has a LAN Ethernet with 30 working stations and four printers. Access to major bibliographic data bases is provided.

In addition, visitors have free access to the scientific infrastructure of the Catalan universities, including the use of the UAB Science and Engineering Library. The CRM has several furnished apartments at its disposal in Barcelona, in the nearby town of Sant Cugat and in the *Vila Universitària* of the Bellaterra campus.

20th anniversary

In the Autumn of 2004 the CRM celebrated its 20th anniversary. On this occasion, Jean-Pierre Serre, first Abel Prize, delivered a lecture during an academic event on November 9, which was presided by the foremost academic and political authorities of Catalonia and Spain. The history of the CRM during its first twenty years of existence has been published in a commemorative volume and a CD. In this period, the CRM hosted 969 visitors from 58 different countries, including 44 post-doctoral fellows. Twenty-four congresses were organised, together with 21 workshops and 23 advanced courses. These events were attended by a total number of 3,480 participants, coming from 72 countries. Many of them —hopefully all— enjoyed Barcelona, the Catalan countryside, or the hospitality of their Catalan colleagues, and keep pleasant memories from their stay.

Jean-Pierre Serre, Collège de France
Groupes finis: Choix de théorèmes
November 9, 2004
Institut d'Estudis Catalans, Barcelona

A few final comments

In mathematical research the exchange of ideas plays a central role; the contact and the transmission of knowledge is the true laboratory for mathematicians. They work in one of the most international sciences, since, compared with other disciplines, it is based less on the use of instruments and more on a strong human contact. This is where the research institutes play a crucial role. They allow not only the exchange of ideas between specialists in the same field, but also the establishment of profound and sometimes surprising links between different lines of research.

For the first time in Catalonia the words of Konrad Knopp, pronounced at an inaugural lecture at the University of Tübingen, are being understood: "Mathematics is the basis of all knowledge and contains all other culture". The complexity of any system and our world is one, increases with the degree of interconnection. A more interconnected world —more global—, is therefore a more complex system and at the same time a more fragile and unstable one. Mathematics has an increasingly decisive role to play in the management of complex systems, (be they technological, financial or social), and therefore it will increasingly be, for those countries which develop high quality research, an instrument of power. Our country, Catalonia, can be one of them.

There have always been internationally recognised Catalan researchers in some scientific areas, and in recent years this recognition has extended to areas where previously we had no presence, as is the case for Mathematics. It is also true that our research groups are becoming more and more visible in the literature. But it is one thing to be known and recognised individually and quite another for the country to be recognised as a scientific community. Without the former we could not achieve the second, but the later must always be an objective of the Catalan mathematical community and of the society in general. In this sense, the Centre de Recerca Matemàtica has also been

an instrument for the international promotion of our country, an instrument that many other countries wish for but do not have.

Today we believe that our mathematical community is richer, that our country is scientifically more developed, and we congratulate ourselves for this and thank all of those who have made it possible.

Let us end this article with a sentence of the letter addressed by Sir John Kingman, President of the European Mathematical Society in occasion of the 20th anniversary of the CRM: "You have put Catalan Mathematics firmly and permanently on the map".

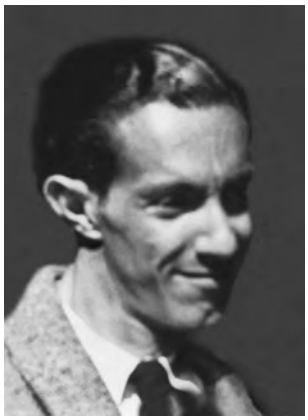
Website

Additional information about the CRM, including full lists of visitors and activities, can be found at http://www.crm.cat.

Manuel Castellet
CRM Director

The Catalan mathematician Ferran Sunyer i Balaguer (1912-1967) and the Prize in his honor

Ferran Sunyer i Balaguer was a self-taught Catalan mathematician very active in classical Mathematical Analysis in the period 1940–1967. Each year, in honor of his memory, the Ferran Sunyer i Balaguer Foundation awards a mathematical research prize, which was awarded for the first time in April 1993.



Ferran Sunyer i Balaguer

A biographical sketch

Ferran Sunyer i Balaguer was born in Figueras (Girona) in 1912, with a practically complete physical disability that confined him for all his life to a wheelchair, and died in Barcelona in 1967. After the early death of his father, he moved in with Ferran's maternal grandmother and his cousins Maria, Àngels and Ferran, who provided the pleasant and suitable environment in which the mathematician grew up. The sickly boy was left with the option to learn by himself or through his mother's lessons. After a period of intense reading, arousing a first interest in astronomy and physics, his passion for Mathematics awoke and dominated his further life. Ferran's physical handicap did not allow him to write down any of his papers by himself. He dictated them to his mother until her death in 1955, and when, after a period of grief and desperation, he resumed research with new vigor, his cousins took care of the writing. His working power, paired with exceptional talents, produced a number of results which were eventually recognized for their high scientific value and for which he was awarded various prizes. In 1938, he communicated his first results to Prof. J. Hadamard of the Academy of Sciences in Paris, who published one of his papers in the Academy's "Comptes Rendus" and encouraged him to proceed in his selected course of investigation. From this moment, Ferran Sunyer i Balaguer maintained a constant interchange with the French analytical school, in particular with Szolem Mandelbrojt and his students. In the following years, his results were published regularly. His research was recognized with a significant number of prizes: Agell Prize, of the Acadèmia de Ciències i Arts de Barcelona (1948); Premi Prat de la Riba, of the Institut d'Estudis Catalans (1949); Premi de l'Academia de Ciencias de Zaragoza (1950); two prizes "Torres Quevedo" and "Francisco

Franco" (1956) of the Consejo Superior de Investigaciones Cientificas; Premi de l'Academia de Ciencias de Madrid (1959), and the Prize Martí d'Ardenya of the Institut d'Estudis Catalans (1966). Despite all honour it was much more difficult to reach the social and profesional position corresponding to his scientific achievements. At times, his economical situation was not the most comfortable either. It wasn't until the 9th of December 1967, 18 days prior to his death, that his confirmation as a scientific member was made public by the División de Ciencias Matemáticas, Médicas y de Naturaleza of the Consejo Superior de Investigaciones Científicas. Furthermore, his election was qualified only as "de entrada", in contrast to the first class election. He always participated and supported guest lectures in Barcelona, many of them having been prepared or promoted by him. On the occasion of a conference in 1966, H. Mascart of Toulouse publicly pronounced his feeling honoured by the presence of M. Sunyer i Balaguer, "the first, by far, of Spanish mathematicians". On December 27, 1967, still fully active, Ferran Sunyer i Balaguer unexpectedly passed away.

The Ferran Sunyer i Balaguer Foundation

In June, 30 of 1983 Mrs. Maria Assumpció Carbona i Balaguer and Maria dels Àngels Carbona i Balaguer, cousins of Ferran Sunyer i Balaguer, created the Fundació Sunyer i Balaguer. This Foundation became inoperative for several years, until it was remodeled by Ferran's cousins in December 1991, entering the Institut d'Estudis Catalans. Since then, the Foundation is presided by the President of the Institut d'Estudis Catalans. The main objective of the Ferran Sunyer i Balaguer Foundation is to award a mathematical monograph of an expository nature presenting the latest developments in an active area of research in Mathematics, in which the applicant has made important contributions. The Foundation may award also other works related to the mathematical research. The Ferran Sunyer i Balaguer Prize is awarded yearly in the Prize Cerimony of the Institut d'Estudis Catalans after the proposal of an International Jury. The conditions of the Prize are:

• The monograph must be original, written in English, and of at least 150 pages. The monograph must not be subject to any previous copyright agreement. In exceptional cases, manuscripts in other languages may be considered.

• The winning monograph will be published in Birkhäuser Verlag's series *Progress in Mathematics*, subject to the usual regulations concerning copyright and author's rights.

• The prize, amounting to 12,000 euros, is provided by the Ferran Sunyer i Balaguer Foundation.

For the 2007 call of the Prize, the scientific committee is formed by: A. Córdoba (Universidad Autónoma de Madrid), P. Malliavin (Université de Paris VI), J. Oesterlé (Institut de Mathématiques de Jussieu), O. Serra (Universitat Politècnica de Catalunya), A. Weinstein (University of California at Berkeley).

Here is the list of winner monographs from the set up of the Prize in 1992:

1992 Alexander Lubotzky, Hebrew University of Jerusalem *Discrete Groups, Expanding Graphs and Invariant Measures*, (Progress in Mathematics, vol. 125, Birkhäuser)

1993 Klaus Schmidt, Warwick University. *Dynamical Systems of Algebraic Origin*, (Progress in Mathematics, vol. 128, Birkhäuser)

1994 The scientific committee decided not to award the prize.

1995 As from this year prizes will bear the year they are awarded, rather than the year they were announced.

1996 V. Kumar Murty and M. Ram Murty, University of Toronto. *Non-Vanishing of L-Functions and Applications* (Progress in Mathematics, vol. 157, Birkhäuser)

1997 A. Böttcher, T. U. Chemnitz and Y. I. Karlovich, Marine Hydrophysical Institute. *Carleson Curves, Mückenhoupt Weights, and Toeplitz Operators*, (Progress in Mathematics, vol. 154, Birkahüser)

1998 Juan J. Morales-Ruiz, Technical University of Catalonia. *Differential Galois Theory and Non-integrability of Hamiltonian Systems*, (Progress in Mathematics, vol. 179, Birkhäuser)

1999 Patrick Dehornoy, Université de Caen. *Braids and Self-Distributivity*, (Progress in Mathematics, vol. 192, Birkhäuser)

2000 Juan-Pablo Ortega and Tudor Ratiu, École Polytechnique Fédérale de Lausanne. *Hamiltonian Singular Reduction*, (Progress in Mathematics, vol. 222, Birkhäuser)

2001 Martin Golubitsky and Ian Stewart, University of Houston, Warwick University. *The Symmetry Perspective*, (Progress in Mathematics, vol. 200, Birkhäuser)

2002 Alexander Lubotzky and Dan Segal, Hebrew University of Jerusalem and All Souls College, Oxford. *Subgroup Growth*, (Progress in Mathematics, vol. 212, Birkhäuser)

André Unterberger, Université de Reims. *Automorphic Pseudodifferential Analysis and Higher-level Weyl Calculi* (Progress in Mathematics, vol. 209, Birkhäuser)

2003 Fuensanta Andreu-Vaillo and José M. Mazón, Universitat de València, and Vicent Caselles, Universitat Pompeu Fabra. *Parabolic Quasilinear Equations Minimizing Linear Growth Functionals*, (Progress in Mathematics, vol. 223, Birkhäuser)

2004 Guy David, Université de Paris-Sud. *Singular Sets of Minimizers for the Mumford-Shah Functional*, (Progress in Mathematics, vol. 233, Birkhäuser)

2005 Antonio Ambrosetti and Andrea Malchiodi, SISSA, Italy. *Perturbation Methods and Semilinear Elliptic Problems on* $\mathbb{R}^n$, (Progress in Mathematics, vol. 240, Birkhäuser)

José Seade, UNAM, Mexico *On the Topology of Isolated Singularities in Analytic Spaces*, (Progress in Mathematics, vol. 241, Birkhäuser)

2006 Xiaonan Ma, École Polytechnique Palaiseau and George Marinescu, Johann-Wolfgang-Goethe Universität. *Holomorphic Morse Inequalities and Bergman Kernels.*

For more information on the Ferran Sunyer i Balaguer Prize and on the Foundation, see the web page http://ffsb.iec.cat.

Pere Pascual Gainza
Director of the
Ferran Sunyer i Balaguer Foundation

Mathematics at the University of Barcelona

Building of the UB

The Cloister

The University of Barcelona (UB) has recently celebrated its 555 anniversary. It is the university of Catalonia which has the biggest number of students and offers the widest and most complete range of courses including undergraduate degrees, masters and doctorate programs. It is also the leading center for university research in Spain in terms of number of research programs and excellence of results. The faculties of the University of Barcelona are distributed along four main campuses in different places of the city of Barcelona.

The University of Barcelona has been offering studies of Mathematics since the 16th century. In modern times the Faculty of Mathematics of the University of Barcelona was cre-

ated in 1974 as a result of the splitting of the former Faculty of Sciences into several new faculties.

It is located at the historical building at Plaça Universitat in the center of the city. The building was begun in 1863 and was declared a national monument of historic and artistic interest in 1970.

The Faculty of Mathematics offers studies of Mathematics, Computer Science and Doctorate of Mathematics.

In the academic year 2006–2007 the new master of Advanced and Professional Mathematics will start in the framework of the European Space of High Education.

The faculty has a staff of 117 people dedicated to both teaching and research. They are organised in several well-established and internationally recognized research groups in the following research areas: Algebraic Geometry, Commutative Algebra, Complex Analysis, Differential Geometry, Dynamical Systems, History of Mathematics, Mathematical Logic, Number Theory, Real and Functional Analysis, Statistics, Stochastic Processes, Topology, Volume Visualization and Artificial Intelligence.

In association with the Faculty there is a research institute called IMUB (*Institut de Matemàtiques de la Universitat de Barcelona*). The Institute is devoted to advanced research and training in any field of pure and applied Mathematics. More precisely, its main objectives are the support to research in Mathematics through the organisation of scientific activities and the promotion of interdisciplinary work among researchers from different fields of Mathematics. It also edites the journal *Collectanea Mathematica*, which was founded by Professor José M. Orts in 1948 and is the oldest mathematical journal in Spain. The journal publishes high quality original research papers in pure and applied Mathematics.

The mathematical library of the University of Barcelona is one of the best in Spain and the biggest of Catalonia. It has about 18,000 monographs and 669 journals.

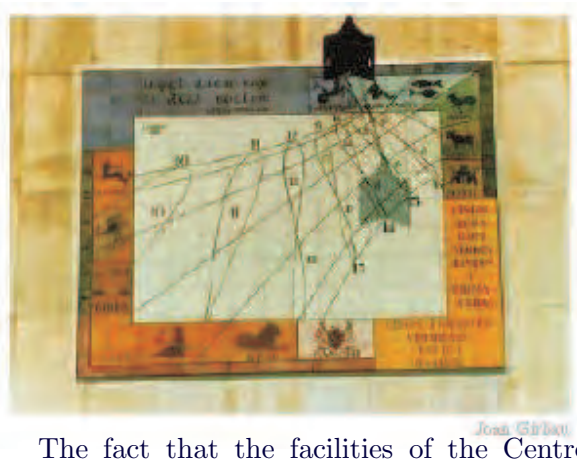
Mathematics Faculty
University of Barcelona

Mathematics at the Autonomous University of Barcelona

Catalonia holds a significant place in international mathematical output, with a 0.5 % share of all publications worldwide. According to the Report on Research in Catalonia (reproduced in this issue of *SCM/Notícies*), Catalonia is in sixth place —after Israel, France, Switzerland, Canada and Denmark— in terms of the number per inhabitant of mathematical articles published in quality journals. In Spain, the university rankings consistently place the Autonomous University of Barcelona (UAB) (www.uab.cat) in the top three or four places and, according to the analysts, the UAB's Department of Mathematics holds the top positions in the different established classifications, due to the quality of its research and its teaching staff.

The UAB's Department of Mathematics has 56 full-time professors, a total teaching and research staff of 129 mathematicians and is home to 13 highly competitive research groups. The department offers graduate studies in Mathematics and statistics and double degrees in Mathematics and computer sciences and Mathematics and statistics, as well as several master's and doctoral courses. The fact that all the areas of Mathematics are grouped in a single department and that the UAB is a campus university strongly favours the multidisciplinary nature of the research and the courses. As a result of this, we boast a department that is unique in the Catalan scientific ambit. It is located at the heart of one of the country's most dynamic

R&D areas, surrounded by 33 important research centres, such as the Centre for Computer Vision, the Artificial Intelligence Centre, the Catalan Nanotechnology Institute and the future Synchrotron Light Laboratory, which will be one of the main scientific facilities of southern Europe. Furthermore, our department is close to the UAB's sports facilities, the university village apartments and to the metro station that links us to the centre of Barcelona.



The fact that the facilities of the Centre de Recerca Matemàtica (CRM) are adjacent to our department and that the CRM is a centre attached to the UAB has given an enormous boost to the quality of research at the department and has helped to get our research groups better known around the world. The close cooperation between the UAB's Department of Mathematics and the CRM is partly responsible for the leadership of our research groups in Catalonia.

We are proud to include among our researchers the only Spanish Salem Prize winner (Xavier Tolsa), the only Spanish Richard von Mises Prize winner (José A. Carrillo) and two of the four most cited Spanish mathematicians (Pere Ara and Jaume Llibre, according to the ISI). Apart from these noteworthy individuals, our 13 research groups also hold important places on the cutting edge of international mathematical research. We have research groups in ring theory, algebraic and arithmetic geometry, geometric group theory, function theory, harmonic and complex analysis, stochastic analysis, mathematical statistics, algebraic topology, differential geometry, dynamical systems, partial differential equations, mathematics education and low-dimensional discrete dynamics. These groups participate actively in projects at the Catalan, Spanish and European levels and have an annual research budget of 1.2M€.

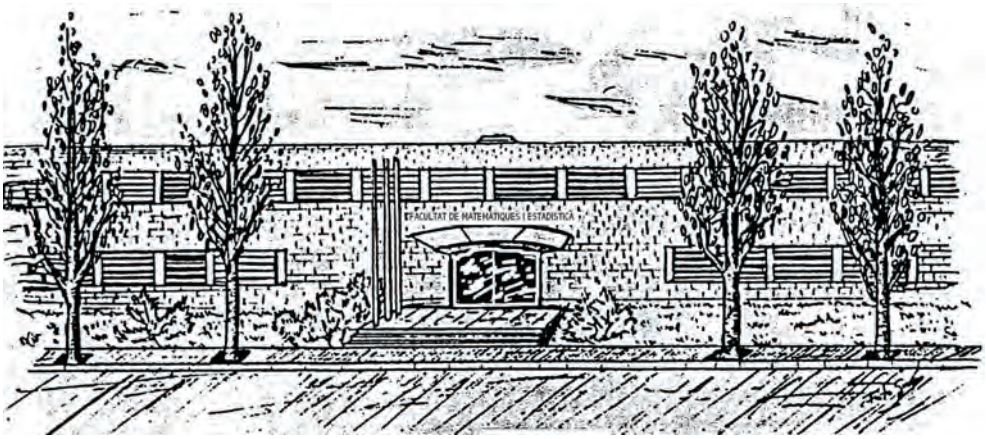
José A. Carrillo

The UAB's Department of Mathematics has published the international research journal, Publicacions Matemàtiques, since 1976. In the 2005 JCR impact factor index this journal is ranked 49 out of 181 journals in pure mathematics and, over the years, has gained a reputation for the quality of its articles and its relatively short waiting time. The journal is published simultaneously on paper and online.

We feel that all of this makes the UAB's Department of Mathematics a sound choice for the best students in Europe when deciding on their choice of master's and doctoral studies. It is also the right choice for young researchers who, through the different research scholarships (Ramón y Cajal, ICREA, Marie-Curie, etc.), seek the opportunity to work and improve in a dynamic and friendly institution. We invite you all to visit our website (mat.uab.cat) and to contact us for more information on study and research in Mathematics at the UAB.

Jaume Aguadé
Director of the Mathematics Department
UAB

Mathematics at the Technical University of Catalonia



The mathematical community at UPC

The Technical University of Catalonia (Universitat Politècnica de Catalunya, UPC) employs over 300 mathematicians, for the most part associated with one of the four departments in Applied Mathematics, with the Department of Statistics and Operations Research or with the Department of Architechture Structures.

Their teaching covers the programs of the Faculty of Mathematics and Statistics, and the Mathematics/statistics of the Faculty of Informatics, of the Schools of Industrial Engineering (schools in Barcelona and in Terrassa, the latter including Aeronautical Engineering), Telecommunications Engineering (schools in Barcelona and in Castelldefels), Civil Engineering, and Architecture (schools in Barcelona and in Terrassa), and of the bachelor degrees offered by several "polytechnic schools".

With 37 established research groups, funded for Research and Technology Transfer Projects with over 3M Euro (2004), its "scientific production and impact factor" was ranked 3rd out of 40 in the "Report 2000" on mathematical production in Spain.[1]

Two Doctoral Programs are offered: *Applied Mathematics* and *Statistics and Operations Research*, both distinguished by the Quality Award of the Spanish Ministry of Education. They output an average of 6-7 and 3-4 PhD per year, respectively.

The FME

Founded in 1992, the UPC Faculty of Mathematics and Statistics (FME) offers degrees in Mathematics and in Statistics and Operations Research.

Mathematics degrees

The FME offers a variety of degrees to suit the widest range of interests and needs, from the most application-oriented to the most theory-oriented.

Higher degree in Mathematics. Students entering the university are offered a 5-year *Degree in Mathematics* (*Llicenciatura en Matemàtiques*), comparable to a BSc+MSc. It is limited to 50 students. The lowest mark for admission is 7/10 and the first year is selective (required to be passed in at most two academic years).

Double degrees. Students of the *Higher Degree in Mathematics* can opt to enrol in a special 6-year program to earn a double degree, the *Higher Degree in Mathematics* and a degree in Engineering (Industrial, Computer Science, Telecomunications or Civil Engineering). Enrolment in these special programs is about one in six of the students in the *Higher Degree in Mathematics* (to qualify, they have to take and pass a special examination).

Graduate courses. With an enrolment of 30 students, the FME offers a graduate course in *Mathematical Techniques for the Financial Markets*.

[1] *La investigación matemática en España en el periodo 1990–1999*. Report prepared by the Spanish Committee for the World Mathematical Year (2000), under the coordination of C. Andradas and E. Zuazua. Edited by the Real Sociedad de Matemáticas (RSME), the Catalan Mathematical Society (SCM), the Spanish Society for Statistics and Operations Research (SEIO) and the Spanish Society for Applied Mathematics (S$\vec{e}$MA).

New master's programs. Starting in September 2006, and in the framework of the European Space for Higher Education (ESHE), the FME offers, in cooperation with the departments of Applied Mathematics, the following 2-year Master's degrees:

- *Applied Mathematics.*
- *Mathematical Engineering.*

Statistics and Operations Research degrees

The degrees offered by the FME in these areas grant students optimal flexibility in designing their careers.

Degree in Statistics. A 3-year degree in Statistics (*Diplomatura en Estadística*). It is a BSc degree totally adapted to the ESHE.

Higher Degree in Statistics. A 2-year degree in higher Statistics (*Llicenciatura en Ciències i Tècniques Estadístiques*). It is comparable to a MSc on "statistical sciences and techniques".

New master's program. Starting in September 2006, and in the framework of the ESHE, the FME offers, in cooperation with the Department of Statistics and Operations Research, a Master's degree in *Statistics and Operations Research.*

Graduate course. With an enrolment of 30 students, the FME offers, in cooperation with the Statistics and Operations Research Department, a graduate course in *Biostatistics.*

New organization

Starting in September 2006, the Doctoral Programs, and the double-degree special programs, are adapted to the new ESHE organization. This ensures that the degrees are valid across the European Union, that the students will have unprecedented mobility opportunities, and that they will be able to follow curricula that truly meet their individual scientific interests and needs.

Student mobility

About 20 students per year take the opportunity to study for some period in other universities. In exchange the FME receives about the same number of students. In general, these exchanges are regulated by a number of bilateral agreements with other universities in the framework of some global exchange program. At present, FME exchanges students with:

- Universities in Madrid, Santiago de Compostela, Sevilla, Cádiz, Granada, Tenerife, Murcia and Zaragoza, in the framework of the Spanish Sicue/Séneca program.
- European Universities in Finland, Norway, United Kingdom, France, Italy, Greece, the Netherlands, Belgium, Switzerland, Portugal and Germany, in the framework of the Socrates/Erasmus European program.

There are also exchanges with Latin-American universities and visitors from the Instituto Tecnológico Autónomo de México.

Cultural life

At the FME there is a rich range of activities beyond Mathematics: music, theatre, sports (including Go and Chess), creative writing, ...

With regard to the lectures' program, in each of the last three academic years it has been catalyzed by its association with a historical figure: Poincaré in 2003–2004, Einstein in 2004–2005 and Gauss in 2005–2006. The lectures can be found in the FME Web page (click at *Butlletí Digital FME*). Moreover, the intention is to publish in book form a selection of the lectures of each academic year, as it has been already the case with Poincaré and Einstein (*Conferències FME*, Volums I and II).

Key sources for further information

– UPC web page: www.upc.edu
– FME web page: www-fme.upc.edu
– FME masters's programs: mastersfme.upc.edu
– FME Office for Mathematics Research (OSRM): www-fme.upc.edu/osrm/

Sebastià Xambó
Dean of the FME[2]

[2]For the preparation of this note, the author wants to thank the efficient assistance of the associated deans (Jaume Franch, Pere Grima, Margarida Mitjana, Eduard Recasens and Oriol Serra) and the useful comments of professors Miguel Muñoz Lecanda and Manuel Martí Recober.

Mathematics at ICREA

The Catalan Institution of Research and Advanced Studies (ICREA) is a foundation created jointly by the *Generalitat de Catalunya* (the autonomous government of Catalonia), and the Catalan Foundation for Research and Innovation (FCRI). ICREA was born in 2001 with the aim of promoting scientific research in Catalonia. Its main instrument towards this goal is the annual call for permanent senior research positions. In addition to this, ICREA is also giving the opportunity to young researchers to join the R+D Catalan System through the ICREA Junior program, divided into *Junior Academia* and *Junior Empresa*, the latter aimed at bringing in scientists to the private sector.

ICREA researchers work in universities and research centers in Catalonia, and in the case of junior researchers also in companies. Currently, there are 119 senior and 13 junior researchers. Two thirds of them were working abroad at the time of being hired by ICREA. Since half of them have Spanish nationality, this means that at least one third of the hirings made by ICREA represent a clear recovery of scientific talent for the country.

ICREA has been able to attract distinguished researchers in many fields and from many different countries. The selection process is based exclusively on scientific and academic excellence, and is carried out by external expert evaluation committees. The annual ICREA calls for positions are announced worldwide, both on-line and in journals like *Nature* or *Science*, and are open to researchers of any nationality. Since ICREA receives over 400 applications from highly qualified researchers, the competition is very strong.

Approximately, 33 % of ICREA researchers belong to the area of life sciences and medicine, another 30 % to experimental sciences and Mathematics, 17 % to technology, 15 % to humanities, and 5 % to social sciences. Mathematics represents a 5 % of the total. This distribution does not obey a pre-determined system of quotas by areas, but it is simply the result of the evaluations of candidates by the expert committees, based only on the need to hire scientific talent.

Periodically, ICREA researchers undergo a thorough evaluation of their scientific work, as well as of their degree of adaptation to their host institution and of the impact of their activity on the local community. The evaluation is based on confidential reports by peers, all from outside Catalonia. Positive evaluations usually lead to a salary increase, while repeated negative evaluations may lead to a termination of the contract.

Besides research, other important activities of ICREA researchers are: teaching of graduate courses and seminars, supervision of doctoral theses, direction of research groups, management of research projects, popularization of science, etc.

At ICREA's web page www.icrea.eu one can find much more information, both on the Institution and its researchers.

The mathematicians of ICREA

Currently, ICREA has 5 senior researchers in Mathematics: Xavier Cabré, José Antonio Carrillo, Sy D. Friedman, Xavier Tolsa, and the author of this article. There is also one junior researcher: David Asperó.

I was hired in the first call, back in 2001. In 1992 I returned to Catalonia after a 7 years stay at the University of California at Berkeley, where I earned my PhD degree and worked as a post-doctoral researcher. After 9 years in several Catalan universities, always with temporary or visiting positions, ICREA gave me a unique opportunity to stabilize my position and remain in Catalonia doing research under suitable conditions. I work at the Department of Logic and History and Philosophy of Science of the University of Barcelona and my area of research is Set Theory and its applications to Analysis (Measure Theory and Banach Space Theory) and General Topology.

In the second call, in 2002, ICREA hired José Antonio Carrillo and Xavier Tolsa. Both work at the Department of Mathematics of the Autonomous University of Barcelona (UAB). The research of J. A. Carrillo focuses on Partial Differential Equations and Mathematical Physics. At the moment of signing his contract with ICREA, J.A. Carrillo was a professor at the University of Granada. In 2003 he was awarded the price of the Spanish Society of Applied Mathematics. And very recently he

has also been awarded the Richard-Von-Misses Prize 2006 of the *Gesellschaft für Angewandte Mathematik und Mechanik (GAMM)*.

Xavier Tolsa was a *Ramón y Cajal* researcher at the UAB, but after some spectacular work in which he solved a famous problem of Painlevé's and proved the additivity of the analytic capacity, ICREA offered him a permanent position so he could stay and carry out his work in Catalonia. In 2002 he received the prestigious Salem price, and in 2004 the price of the European Mathematical Society. He is one of the invited speakers at the ICM 2006. His areas of research are Harmonic and Complex Analysis.

In the 2003 call for positions ICREA hired Xavier Cabré and Sy D. Friedman. X. Cabré works at the Department of Applied Mathematics I of the Technical University of Catalonia, in Barcelona, and his area of research are the Partial Differential Equations. He obtained his PhD at the Courant Institute of New York and was Associate Professor at the University of Texas at Austin until 2003, when he returned to Catalonia.

Sy D. Friedman was for 26 years Professor of Mathematics at the Massachussetts Institute of Technology, and is currently *Ordentliche Universitäts-Professor* and Director of the Kurt Gödel Institute for Mathematical Logic at the University of Vienna. He is joining ICREA gradually and his total incorporation at the Centre de Recerca Matemàtica, in Bellaterra (Barcelona), is expected to take place during the academic course 2006–2007. He works on Mathematical Logic.

Finally, in 2005, ICREA hired a junior researcher in Mathematics, David Asperó. He got his doctorate at the University of Barcelona and has been a postdoctoral researcher in Vienna, Helsinki, and Bristol. He is currently at the University of Barcelona and his research interests are in Set Theory, especially forcing axioms and combinatorics.

It is expected that in the next years ICREA will continue hiring mathematicians, both senior and junior, who will contribute with their work to the increase in quality of the mathematical research done in Catalonia.

Joan Bagaria
ICREA Director's Scientific Advisor and
ICREA Research Professor

Federació d'Entitats per a l'Ensenyament de les Matemàtiques a Catalunya (FEEMCAT)

Introduction

The Federation of Organisations for the Teaching of Mathematics in Catalonia (FEEMCAT) is a non-profit association and its objectives are to improve the teaching of Mathematics at all levels of education, by improving teacher training, the mathematical training of students and society's view of Mathematics.

Apart from the groups that currently form part of FEEMCAT, at the beginning the Federation also included the participation of groups of Mathematics teachers and lecturers working in Girona (Grup Perímetre, Grup +3), Osona (Grup + o −), Lleida and Tàrrega (Grup Nombres de Ponent), and Barcelona (Grups Almosta de l'Associació de Mestres de Rosa Sensat) The Societat d'Ensenyants de Matemàtiques del Garraf (Society of Mathematics Teachers of El Garraf, SEMG) also formed part of the Federation between 1999 and 2005. Most members of these groups have gradually joined the associations that make up the Federation today:

- Associació d'Ensenyants de Matemàtiques de les Comarques Gironines (ADEMGI)
- Associació de Professors de Matemàtiques de les Comarques Meridionals (APMCM)

- Associació de Professors de Matemàtiques del Maresme (APaMMs)
- Associació de Barcelona per a l'Estudi i l'Aprenentatge de les Matemàtiques (ABEAM)

Twelve years of activities

Journal *Biaix*

BIAIX was set up in April 1992 and is currently the only journal on Mathematical Education written entirely in Catalan. To find out all about *BIAIX* today, you can visit the website: www.xtec.es/entitats/BIAIX, where you will find the online version of the most recent issues.

Meetings and Congresses on Mathematical Education

In recent years, there have been more than 40 meetings with a total participation of more than 5,000 Mathematics teaching professionals.

Courses, seminars and work groups

Open to all teachers in Catalonia.

Maria Antònia Canals Prize

In 2002, FEEMCAT created the Maria Antònia Canals Prize with the aim of promoting innovation in education in the area of Mathematics at all levels of teaching, from pre-school to university.

Fem Matemàtiques

Fem Matemàtiques (Let's Do Mathematics) is currently an annual activity organised by FEEMCAT with the aim of contributing toward developing mathematical competence in all students in the sixth year of primary education and the first year of secondary education. It also provides for promoting experiences and sharing proposals by the teaching staff from different parts of Catalonia, and aims to raise the awareness of Catalan society in general about the need to improve a mathematical education that encourages the personal development and social integration of free and responsible citizens.

ESTALMAT

FEEMCAT and the SCM agreed in 2002 to jointly organise the Estalmat activity in Catalonia under the auspices of the Royal Academy of Sciences and with the support of the Vodafone Foundation. For more information, visit the project's website: www.estalmat.org

Working for the future

The Federation recently took part in the curricular debate at the Department of Education. For more information, you can visit the site www.gencat.net/educacio/debat. The document on technical and scientific education is available at the website http://xtec.net/e13_debatcurricular/docs/3.cientific.pdf. We have also contributed to the National Agreement on Education in Catalonia. You can view the document at http://www.xtec.net/entitats/feemcat/historia/activitats05/pne.pdf.

We are working for Catalonia to host a JAEM congress soon (Meeting on Teaching and Learning Mathematics). The Federation also continues with its aim to maintain the high standards achieved by the work groups in our activities and to take the first steps to form a team of teachers to design and create mathematical exhibitions.

Coordination work and relations with other organisations and between research groups, innovation teams and teachers associations require considerable development in order to be able to cooperate in research on adapting mathematical education to today's social challenges.

Pilar Royo
FEEMCAT President

Societat Catalana de Matemàtiques

SCM Funds

Activites Promotion Fund

The SCM General Assembly, in its meeting of June 3, 2003, approved the creation of a fund called *Fons de Promoció d'Activitats* (Activities Promotion Fund). This fund had an initial amount of 102,372.90 euros, and is devoted to supporting new activities undertaken by the SCM itself, as well as supporting other activities involving the teaching or research in Mathematics, organised by Catalan institutions or working groups, provided that these activities benefit the Catalan mathematical community and conform to the statutory goals of the SCM.

In all cases alternative or partial financial support should be seeked for the activities that apply to this fund. One of the goals is to help organisers in the early stages of preparation of their activities, hence a bigger sum can be initially delivered, and when the final budget is established part of it will be eventually returned. Proposals are submitted to the Executive Board of the SCM, which decides on the applications. If necessary the Scientific Committee or the Teaching Committee of the Society can be consulted by the Board. The General Assembly of the SCM is informed, once a year, of the activities organised with the fund's help, and of the financial managing of the fund itself.

Among the external activities supported by the fund up to now, we can mention:

- XI Topology Meeting (Barcelona, March 2004)
- Special Session on Algebraic Geometry in the conference MAT.ES (Valencia, January-February 2005)
- 4th Congress of the European Society of Research in Mathematical Education (Sant Feliu de Guíxols, February 2005)
- Algebraic and Topological Methods in Non-Classical Logics II (Barcelona, June 2005)
- Primeras Jornadas de Teoría de Números (Vilanova i La Geltrú, June-July 2005)
- Winter School on Commutative Algebra and Applications (Barcelona, January-February 2006)
- Gödel Centenary Day (Barcelona, May 2006)
- Geometric and Asymptotic Group Theory with Applications (Manresa, September 2006)
- Barcelona Analysis Conference (Barcelona, September 2006)
- Topology of Complex Algebraic Varieties (L'Alguer, Italy, September 2006)
- Eurocrypt (Barcelona, 2007)

Cooperation Fund

The SCM General Assembly, in its meeting of June 29, 2005, approved the creation of a fund called *Fons de Cooperació* (Cooperation Fund). The aim of this fund is to promote the participation of mathematicians from developing countries in the activities organised in the scope of the SCM, either by the SCM itself or by others. The amount devoted yearly to this fund should be not less than the 0.7 % of the Society's income from membership fees. The Executive Board will determine the list of eligible countries, in accordance with the criteria used in similar organisations.

This fund will be available both to individuals who want to attend the eligible activities, and to the organisers of these who want to promote the participation of mathematicians from the eligible countries in the activity they are organising.

This fund will be also used in direct actions that share the same goal, including cooperation with the Committee of International Cooperation and Development of the Spanish Committee of Mathematics, of which the SCM is one of the four founding societies; following its initiative, at the end of 2005 a shipment of mathematical textbooks was sent to Morocco, Nicaragua and Paraguay.

Josep M. Font
Secretary of the SCM

The Czech-Catalan venture: a fruitful collaboration

The Czech Republic and Catalonia share some characteristic features: relatively small European countries with a healthy sense of national identity and a strong belief in culture and science.

Stamps published in occasion of the Congres

The connection between the mathematical communities in the two countries can be traced back to the early 70's, usually based on personal collaboration. These contacts were strong enough to consider the formalization of an official agreement between the Czech and Catalan mathematical societies, which was signed in the occasion of the the second Joint EMS Mathematical Weekend held in Prague in September 2004.

From the very beginning there was a definite will to go beyond the usual reciprocity agreements and to create a real framework of collaboration which would enrich the mathematical and human connections between the two communities.

One of the highlights of this agreement has been the organisation of CSM-SCM Joint Mathematical Meetings. The first edition was held in Prague in May 2005 with great success. The meeting gathered some 100 mathematicians from both communities in areas with existing collaboration: Computational Statistics and Data Analysis, Discrete Mathematics and Computer Science, Homotopy Theory, Logic, Functional and Real Analysis and Ring and Module Theory. A special series of mail stamps was produced to commemorate the event. Moreover, the Catalan partners were invited as observers to the Czech-Slovak competition for young researchers in order to study the organisation of a similar competition involving young researchers of the two countries.

In this first meeting it was agreed to have a second edition in Barcelona, which will be held in September 2006. The meeting is again organised around special sessions, this time involving Computational Statistics and Data Analysis, Discrete Mathematics and Computer Science, Logic, Mathematical Physics and Ring and Module Theory. The meeting will also welcome a special session devoted to the young researchers competition, gathering the winners of the Czech-Slovak and the Catalan ones.

The Czech-Catalan collaboration is sitting on the firm base of a real mathematical exchange. It shows that such cooperation among communities of manageable size can be extremely fruitful and Europe can draw great benefits from its characteristic diversity.

Oriol Serra
UPC

La prova Cangur, the Catalan Kangaroo

By the end of 1995, the Catalan Mathematical Society had been organising the Catalan stage of the Mathematical Olympiad within the framework of the IMO (International Mathematical Olympiad) for many years. The then governing board of the SCM got wind of an activity called the "Kangaroo" that had a very different aim from that of the Olympiad: its goal was to stimulate and motivate a broad majority of students and encourage everyone to take part in a mass scientific demonstration in the form of a real Mathematics festival. The activity is a game aimed at attracting the largest possible number of students without drawing comparisons between countries.

It was with this goal in mind that André Déledicq created *Le Kangourou des mathématiques* (Mathematics Kangaroo) in France in 1991. He gave it this name because it was based on the model of the Australian national competition invented in Canberra in the late 1980s by Peter O'Halloran. At that time, the competition was the only one of its kind and its goal was the participation of vast numbers of students, regardless of their academic level and output. This popularizing activity spread rapidly to several European countries and was consolidated by the founding of the international association *Kangourou Sans Frontières* (Kangaroo without Frontiers), created in 1995 with the sponsorship of the Council of Europe. Other countries in Asia and America have since joined.

Francisco Bellot created the *Asociación Canguro Matemático* (Kangaroo Mathematical Association) in Castilla-León and the first edition was held in 1994. It was he who passed the news on to the members of the SCM and with his formal support, the first Kangaroo competition in Catalonia was held in late 1995, almost as an experiment. The level of results was interesting and there was very positive feedback about the activity and so the board of the SCM decided to give it strong backing.

Participation grew and the Kangaroo became consolidated as an annual event in Catalonia. For this reason, the SCM applied to have its own national representative in the *Kangourou sans Frontières* association and has been a member since 1999. Our Kangaroo has grown tremendously. The SCM Kangaroo committee has moved from being merely Catalan to representing Catalonia, Valencia and the Balearic Islands, thus covering the three Catalan-speaking territories. Between the first and eleventh editions, the number of participating centres multiplied by 4 and the number of participating students by more than 11. The following table is quite explicit:

	SCM Kangaroo (I: 1996; XI: 2006)										
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
Level 1	648	666	833	1,663	2,255	2,425	3,031	3,659	4,113	4,839	5,288
Level 2	453	696	867	1,323	2,072	2,544	2,098	3,082	4,049	4,621	5,260
Level 3	212	473	576	742	961	1,311	1,590	1,802	2,309	2,942	3,176
Level 4	- - -	275	329	414	619	599	765	967	1,219	1,410	1 ,774
Students	1,313	2,110	2,605	4,142	5,907	6,879	7,484	9,510	11,690	13,812	15,498
Centres	106	126	167	244	299	297	314	372	406	450	487

We say that out Kangaroo has grown very big, though anyone comparing this data with that of other countries would draw the opposite conclusion. But there is an aspect of the organization of the SCM's Kangaroo that is quite different from that of other countries, where the problems are sent out to each centre and the Kangaroo takes place almost as a regular class activity.

Here, the idea materialised of *doing maths together*, at the same time as colleagues from other centres, other towns and other countries and the competition was organised in *headquarter centres* that took in participants from other centres. Mathematical fun activities complementary to Kangaroo were often prepared and lunch provided. And so, on the whole, the event became the *Mathematics celebration*.

This philosophy, aimed at sharing Kangaroo headquarters among several centres, often on a rotational basis from one year to the next, was a resounding success. In following editions, several regional civic centres and the universities of Catalonia and Valencia offered their classrooms so that groups of students could come together to take part in the Kangaroo. The idea of a festival does not prevent, but rather encourages the desire to enjoy oneself while getting to grips with the mathematical challenges posed. *Doing Mathematics* is unquestionably about solving problems. And if you can enjoy yourself at the same time, as most Kangaroo participants do, the aim has been achieved.

At the Kangaroo committee, we are happy to see how, year after year, the enormous geographical diversity of the participants is reflected in the prize winners. Among the prizes awarded this year in a ceremony presided over by Catalan educational authorities (held in recent years in the Aula magna of the Catalan universities with Mathematics degree courses), the mentions that acknowledge up to 1 % of the best participants in each level and the prizes for other activities, which we will discuss later, have provided 165 distinctions and we can say that there are no "specialist centres" as the students receiving the awards belonged to 116 different centres. We believe that this diversity is largely responsible for the success of the Kangaroo.

Another aspect that may make the organisation of our Kangaroo different from that of other nations is the constant feedback. The organising committee is open to suggestions from the entire school community that drives participation in the different centres. This exchange of opinions makes it easy to collect many interesting ideas and we will always be more likely to implement them if we really listen to the teachers of the participating centres than if we just limit ourselves to the ideas of the committee members.

For example, this was how the idea of holding the Kangaroo in university centres came about and these teacher meetings have also given birth to some interesting complementary activities, such as sprint problems, poster competitions and short-story competitions.

In 2000, the World Mathematical Year began with a competition to solve problems aimed at teams in the centres and designed to be run online over the Internet. This activity is now called *Sprint problems* because the first team to send all the correct answers is, naturally, the winner. To date there have been 10 editions which were highly rated by the participating centres. Each centre organises the team as they see fit, with the sole condition that the team must be of mixed levels (ages between 15 and 18

years). There are problems with different levels of difficulty and the groups of students who tackle the "easier" problems must pass on information to the groups doing the "harder" problems, thus establishing complicity between students from different classes-something everyone sees as very positive.

Here is the opinion of one of the centres that took part in the latest edition:

> We felt it was very important that no boy or girl should feel excluded from an activity like problem solving. We can also see that the different levels of difficulty of the problems helped us to handle the diversity of students. We insisted that everyone was capable of solving some of the problems. In fact, we were not thinking of a prize. The students were distributed in groups throughout the school (which is linked by cable) and each group started with different problems and then compared results.

At the organising committee, we believe that the statement that the students were all "capable of solving" mathematical problems more than covers the goal of the activity and encourages us to continue.

Another area where the Kangaroo aims to promote activities based on suggestions from the different schools is the interdisciplinary area, interrelating Mathematics with other areas of education and culture.

With this objective in mind, since 2002 there have been three calls for posters to go alongside the official logo of *Le Kangourou*, work of Raoul Rabba, in order to personalise our Kangaroo. The results have revealed an outstanding quality of design and this has sometimes made us reluctant to organise a new competition as we do not wish to abandon something we have made our own.

Finally, the first *Kangaroo short story competition* was held in 2005 for short stories with a Mathematics-related theme. As with all activities in the framework of our Kangaroo, this competition was aimed at the 15-18 age group. In Catalonia, there are other associations grouped in FEEMCAT (Federation of Organisations for the Teaching of Mathematics in Catalonia) that carry out similar work for younger children aged 11 to 14 who are in the last years of primary school and the first years of secondary school. The success of both these competitions in terms of quantity and, especially, quality has encouraged us to continue.

Who knows? Perhaps, in the future, we will sign up to the linguistic Kangaroo being organised by our Romanian colleagues or maybe we will organise a Kangaroo fun run, though indeed the real race to run is ensuring that each year the Kangaroo shows many boys and girls that *doing Mathematics* can also be a real festival.

Antoni Gomà
Chair of the *Cangur* commission

Winners of the 10th *Cangur*

Brief history of the SCM/Notícies

Number 0 of the journal *SCM/Notícies* appeared in February 1995. It was designed to be a periodical that would expand and improve on *Noticiari de la SCM*, a two-page publication containing the most relevant Catalan and international Mathematics news.

Carles Casacuberta was the editor of the original *Noticiari*. The first four issues, published in 1993 and 1994, announced the Leibnitz scholarships, the Ferran Sunyer i Balaguer Prize, ICM 94, the CRM's postdoctoral scholarships and semesters on Dynamical Systems and Differential Geometry, Europroj 94, the 6th Pedagogical Meeting, Temu 95, the awarding of the Catalan autonomous government's Cross of Saint George to Lluís Santaló, the winners of the Fields Medal and the publication of the complete works of Pere Menal.

In February 1995, Sebastià Xambó was elected chairman of the Catalan Mathematical Society (SCM). One of the milestones of the chairman and the board was to expand *Noticiari* and so *SCM/Notícies* was born. The first editorial board was made up of Carles Casacuberta, Joaquín Ortega and Antoni Gomà, and was coordinated by Sebastià Xambó himself. The aim was not just to produce a journal of Catalan and international Mathematics news and inform SCM members about the activities being promoted by the new board, but also to provide a means of popularising Mathematics in Catalonia and a natural medium of communication for the Catalan Mathematics community —"our newspaper".

Looking back over more than 10 years of history, these goals have all largely been achieved. Today, *SCM/Notícies* is a well-known periodical in Catalan mathematical circles, both in universities and secondary schools, and is fulfilling its role as a nexus and information point for Catalan mathematicians.

But let us go back to its beginnings. J. L. Ruiz of the Technical University of Catalonia began designing *SCM/Notícies* and Butlletí in LaTeX2e in 1995. The result was an scm.cls file that made editing the journal very easy and gave it its own individual style. Other people have also made decisive contributions to these editing and formatting tasks: J. Trias wrote a PostScript program to help with editing figures, Toni Escolà took part as the IEC's head of publications and later, in 2001, Teresa Sabater designed the journal's current format, which made its debut in Number 15, and Joan Torregrosa put it into LaTeX. Finally, Maria Julià has, with much care, dedication and efficiency, taken charge of composition and final publication since Number 9 and Núria Fuster at the SCM Secretariat is always on call for all the administrative work.

SCM/Notícies introduced permanent sections that have been consolidated over time and are still featured. The Problems section appeared in Number 0, as a space for readers to solve and propose problems, together with the Book Review section. The Theses section was introduced in Number 1, containing systematic reviews of all Mathematics theses read in Catalonia.

The Problems section was initially coordinated by Antoni Gomà, with the help of Josep Grané, coordinator of the Mathematical Olympiad in Catalonia, who provided the material for these tests. Josep Grané has also been on the *SCM/Notícies* editorial board since its inception.

Antoni Gomà, the coordinator of the Kangaroo contest in Catalonia, also writes regularly for *SCM/Notícies* providing all the information regarding this contest-dates, winners, participants, etc. The Kangaroo and Olympiad sections are permanent and, at this stage, classic sections of *SCM/Notícies*.

Pelegrí Viader and Anna Pol replaced Joaquín Ortega on the editorial board of *SCM/Notícies* in Number 7.

At the request of Sebastià Xambó, I took charge of *SCM/Notícies* from Number 9 onwards, with a board of editors made up of Sebastià Xambó, Antoni Gomà, Josep Grané and Carles Casacuberta. The Theses and Book Review sections were kept on and became my responsibility. The Problems section was handed over to Pelegrí Viader. A special section was started on 3ecm, Barcelona 2000 and was run by Carles Casacuberta.

For a few issues around Number 10, a section was run on language considerations that dealt with the correct way of translating into Catalan those technical words or expressions

that we as mathematicians commonly use in the original English or for which we devise rough-and-ready translations.

From Number 16, the Problems section was taken over by Carles Romero and in Number 18, the Column of the European Mathematical Society, now the International section, was begun under Marta Sanz.

I was replaced as editor by Enric Ventura in Number 20. Antoni Gomà, Carles Romero, Marta Sanz and Josep Pla, who has lately taken over the Book Review section with a large dose of initiative, continue to work with him. The four issues published under his direction (the latest of which is the special ICM 2006 issue you are now reading) continue the general lines of the journal, maintaining the traditional sections and introducing new and interesting ones, such as the Debate Forum for debate between members, the Universities Inform and Activities with the Collaboration of SCM sections and the new page on mathematical websites.

Below is a list of the most noteworthy news published in the 22 issues of *SCM/Notícies* over these past 11 years:

- Tribute to William K. Clifford (*SCM/Notícies* 1).
- The Taylor and Wiles Proof of Fermat's Theorem (*SCM/Notícies* 3).
- Realism in Mathematics (*SCM/Notícies* 7). Translation by Antoni Gomà of an article by Morris W. Hirsch in the AMS Bulletin issue 32, 1995.
- The 1998 Fields Medals (*SCM/Notícies* 9).
- 3ECM (*SCM/Notícies* 10).
- Interview with Professor Josep Vaquer (*SCM/Notícies* 11).
- Interview with Shiing Shen Chern (*SCM/Notícies* 12). Translation by Imma Gálvez of the interview published in AMS Notices, 45, Number 7.
- Gerbert d'Orlhac and Scientific Culture in the Year 1000 (*SCM/Notícies* 12).
- World Mathematics Year. Day at the Congress of Deputies (*SCM/Notícies* 13).
- Third European Mathematical Congress Closing report (*SCM/Notícies* 14).
- Meeting of Deans and Directors of Mathematics in Barcelona (*SCM/Notícies* 15).
- Tribute to William Tutte (*SCM/Notícies* 17).
- Tribute to Lluís Antoni Santaló (*SCM/Notícies* 18).
- 20th Anniversary of the CRM (*SCM/Notícies* 20).
- Debate Forum on the Training of Mathematics Teachers (*SCM/Notícies* 21).
- Honorary Doctorate conferred on Jean-Pierre Serre by the University of Barcelona (*SCM/Notícies* 21).
- EMS-SCM Joint Mathematical Weekend (*SCM/Notícies* 22).
- Let's Talk Books (*SCM/Notícies* 22).

The evolution of the quality of this popularising journal throughout its 11 years of existence (in terms of both form and content) is nothing more than the reflection of the vitality of the Catalan Mathematical Society and the Catalan mathematical community in general, far more than the few nuggets contributed by those of us who have worked on it in the past and those who work on it today. I cannot therefore finish without saying thanks to the many SCM members for their selfless collaboration in the publication of *SCM/Notícies* over the years. Without your contribution (as authors, editors, translators, reviewers, etc.) we could not have made this journal happen. Thank you all.

Agustí Reventós Tarrida
Former Editor of *SCM/Notícies*

Reproduction of Featured Articles

For the sake of completeness, in this section we provide English translations of three articles that have appeared recently in *SCM/Notícies*. The first article appeared in *SCM/Notícies* 21 on the occasion of the doctorate honoris causa for J.-P. Serre at the University of Barcelona. The second, also from number 21, is an article on a prize awarded to a young Catalan mathematician at 4th European Congress of Mathematics. Finally, the third article, from *SCM/Notícies* 20 is a tribute to Miguel de Guzmán, a distinguished and highly acclaimed Spanish mathematician who passed away in April 2004.

Jean-Pierre Serre, doctor honoris causa at the UB

At about midday on 10 November 2005 in a rather intimate ceremony presided by the rector and held in the meeting room of the rector of the University of Barcelona (UB), Jean-Pierre Serre was made an honorary doctor. The honorary doctorate was proposed by the UB number theory research group and was put forward for approval to the Board of Governors by the Faculty of Mathematics, as stipulated in the regulations.

Thus far, the news could have come from an agency. However, I think it would be a good idea to give it further coverage, though with a more personal take.

Jean-Pierre Serre needs no introduction—at least not for most mathematicians interested in topology, geometry, algebra or number theory. He is well known as a leading light in and master of these disciplines. There are many articles that discuss his personality and his scientific work. He is also notable for the number of prizes and distinctions he has received (and continues to receive) throughout his career as a mathematician.

But I am not going to talk about that: you will find a perspective on this in the *laudatio* speech made by the sponsor of the event, Dr. Pilar Bayer, in the conferring ceremony and which accompanies this article with her permission.

We may agree or disagree with or be indifferent to the prizes or distinctions, but there is no question that if any mathematician deserves the recognition, due to both his scientific work and his personality, it is Jean-Pierre Serre. In a world in which non-media events are either condemned to obscurity or forgotten and where similar events are often programmed solely for the media coverage they generate, the conferring of an honorary doctorate on Jean-Pierre Serre by UB is a breath of fresh air that helps to keep alive our faith in academic institutions and in what is expected of them. Those of us in the group sponsoring the event did not want it to be full of pomp, which would be the case if it were to be held in the Paranimf theatre, with the media and cameras everywhere distracting the attention of the large audience that turns up to a social affair. This, however, was not the intention and so a small room was chosen that would barely take 50 people, and even then not everybody could get in and some had to listen to the speeches from outside the open door.

Jean-Pierre Serre at the UB

The naturalness of Jean-Pierre Serre was patent, even at this event. He came to Barcelona, where he gave a conference at the Institute for Catalan Studies (IEC) to commemorate the 20th anniversary of the Mathematical Research Centre and two further conferences at the Barcelona Number Theory Seminar (STNB). The first conference was at the IEC on 9 November. His conferring was on 10 November, having given the first of his 2 conferences at the STNB first thing that morning. The following day, he gave the last of his series

of conferences. His speech before the rector was not exactly a speech in response to the *laudatio*. I shall quote from memory the translation of something Jean-Pierre Serre said during his acceptance speech: "It would be rude to reject the laudatory comments in the speech —and worse to accept them".

Artur Travesa
UB

Laudatio

Monsieur le Recteur, Autorités académiques, Mesdames et Messieurs, Professeur Serre,

C'est pour moi un honneur, ainsi qu'une responsabilité, de prononcer la *laudatio* du professeur Serre à l'occasion de son investiture en tant que docteur honoris causa de l'Université de Barcelone, sur la proposition de la Faculté de Mathématiques.

Jean-Pierre Serre est l'un des chercheurs les plus prisés et les plus appréciés de la communauté mathématique internationale. Né à Bâges, ville du sud de la France, il a fait ses études de mathématiques à l'École Normale Supérieure de Paris. Il a collaboré au Séminaire Cartan pendant quinze ans, en tant qu'étudiant de doctorat puis comme diplômé. À partir de 1948, il a été un des rédacteurs anonymes de l'ouvrage de caractère encyclopédique *Éléments de mathématique* qui était publié en France depuis 1939 sous le pseudonyme de N. Bourbaki.

Les débuts de sa carrière de chercheur ont eu lieu pour l'essentiel au C.N.R.S. (Centre National de la Recherche Scientifique), ainsi qu'à l'Université de Nancy et à Princeton. À trente ans, il a été nommé titulaire de la chaire d'Algèbre et Géométrie du Collège de France, et il s'est consacré exclusivement à la recherche. Aujourd'hui, il est professeur émérite de cette institution.

Jean-Pierre Serre a cultivé la topologie, la géométrie, l'algèbre et la théorie des nombres, traitant souvent ces matières comme un tout et rendant évidente sa compétence par la découverte de connexions fascinantes. Ses premiers travaux sur la topologie algébrique comprennent sa thèse sur l'homologie singulière d'espaces fibrés, les espaces de lacets et les applications au calcul de groupes d'homotopie de sphères. Ses premiers travaux sur la géométrie algébrique comprennent le mémoire sur les faisceaux algébriques cohérents (FAC), qui a été source d'inspiration de la future théorie des schémas. Ces contributions premières, prémonitoires d'une carrière exceptionnelle, lui ont valu de recevoir la médaille Fields, la plus grande distinction mathématique de l'époque. Serre avait alors vingt-sept ans et, encore aujourd'hui, il demeure le plus jeune lauréat de cette récompense qui s'adresse aux chercheurs et chercheuses âgés de moins de quarante ans.

Il est titulaire de nombreuses autres distinctions parmi lesquelles on remarquera la médaille d'or du CNRS, qui lui a été décernée en 1987. L'année dernière (2003) il a reçu le prix Abel de l'Académie des Sciences de Norvège, lors de sa première édition. Instauré avec un caractère annuel en mémoire du mathématicien norvégien Niels Henrik Abel (1802-1829), ce prix a pour intention de compenser l'inexistence de prix Nobel pour les mathématiques.

Jean-Pierre Serre est l'auteur d'une œuvre mathématique profonde et vaste, d'un grand impact. Étant donné qu'il est absolument impossible de la synthétiser en quelques mots, je me limiterai à en présenter une ébauche, mettant en relief certains aspects particuliers de son influence.

Il est l'auteur d'une série d'ouvrages qui sont devenus des classiques dans leurs domaines de spécialisation respectifs. La plupart ont été l'objet de nombreuses traductions et éditions. Les textes, *Groupes algébriques et corps de classes* [1959], *Corps locaux* [1962], *Cohomologie galoisienne* [1964], *Lie Algebras and Lie Groups* [1965], *Algèbre Locale. Multiplicités* [1965], *Algèbres de Lie semi-simples complexes* [1966], ont représenté pour nombre d'entre nous la possibilité de nous familiariser avec un matériel spécialisé d'accès difficile. Leurs sujets, les problèmes et les techniques qu'ils contiennent ont entraîné la formation de chercheurs en algèbre, en géométrie et en théorie des nombres. Dans le Département

d'Algèbre et Géométrie, et à partir d'un certain âge, chacun de nous a quelque texte de Serre lié d'une manière ou d'une autre à une époque de son passé.

Ses ouvrages *Représentations linéaires des groupes finis* [1968] et *Cours d'arithmétique* [1970] font partie de la bibliographie recommandée dans des cours que nous donnons pour la maîtrise. Son cours d'arithmétique a été traduit en chinois, en anglais, en japonais et en russe. En 1995, vingt-cinq ans après sa première édition, ce petit bijou a reçu le prix Steele d'exposition mathématique décerné par l'*American Mathematical Society*.

D'autres ouvrages de Serre, comme *Abelian l-adic representations and elliptic curves (McGill)* [1968], *Arbres, amalgames,* SL_2 [1977], *Lectures on the Mordell-Weil Theorem* [1989], *Topics in Galois Theory* [1992] ainsi que son apport à *Cohomological Invariants in Galois Cohomology* [2003], intègrent du matériel de ses cours spécialisés. Dans un autre ordre d'idées, la *Correspondance Grothendieck-Serre*, éditée en 2001 et annotée par Serre lui-même, aide à saisir la genèse de la remarquable transformation qu'a subie la géométrie algébrique à partir de 1955.

Le noyau dur de l'œuvre de Serre est constitué par ses articles de recherche, qui ont été réunis par la maison d'édition Springer dans un total de quatre volumes. Les *Œuvres - Collected Papers* [1986 ; 2000] réunissent cent soixante-treize articles ordonnés chronologiquement, et elles constituent l'un des apports les plus enrichissants de la mathématique de notre temps. Les notes techniques qui accompagnent chaque article sont aussi d'une grande valeur.

Les articles de théorie des nombres sont déjà présents dans les volumes I et II, et ils occupent la presque totalité des volumes III et IV. Il ont eu une influence sur de nombreuses recherches et ont joué un rôle fondamental dans les résultats les plus remarquables obtenus ces dernières années dans cette discipline. Je voudrais juste signaler que la situation exacte des représentations de Galois module p de degré 2, conjecturée par Serre [Oe 143, 1987] et prouvée dans un cas très particulier par Kenneth Ribet [1990], a été la clé de voûte qui a permis la démonstration d'Andrew Wiles du Théorème de Fermat, huit ans plus tard [1995]. On résolvait de cette manière un problème sur les nombres qui, énoncé au XVIIe siècle par le mathématicien et juriste français Pierre de Fermat (1601–1665), était étudié depuis trois cent cinquante ans.

Serre est un mathématicien de premier ordre qui ne fuit pas le contact avec les autres. Ses enseignements s'adressent de façon générique aux chercheurs et ils s'exercent au moyen de conférences dans des congrès, des séminaires, etc., en plus des cours qu'il donnait chaque année au Collège de France. Ses dissertations, toujours des modèles du genre, constituent un abrégé équilibré de concepts et de techniques ; ses questions deviennent souvent une source d'inspiration pour ceux qui l'écoutent. D'autre part, son aversion pour l'erreur est proverbiale, ce qui implique un degré élevé d'exigence envers lui-même et envers les autres. Arrivé à ce point de mon exposé, je crois que c'est un devoir de gratitude vers lui d'expliciter son influence sur nous ainsi que la part de sa production qui nous a le plus frappés.

La première fois que j'ai écouté le professeur Serre de vive voix c'était en 1974, au cours des *Journées arithmétiques* de Bordeaux. J'étais alors une étudiante de doctorat engagé à la UB et la UAB et j'assistais à mon premier congrès international. Serre en a été le premier conférencier : *Valeurs propres des opérateurs de Hecke module l* [Oe 104, 1975]. J'en ai tiré... que je devais étudier beaucoup plus ! Plus tard, du temps de mon contrat post-doctorat de plus de trois ans à l'université allemande de Regensburg, j'ai eu l'occasion de parler avec lui en diverses occasions : à Bonn, à Oberwolfach, etc. Mais la rencontre la plus importante s'est produite en 1982, lors d'une visite qu'il faisait à Barcelone, au cours de laquelle il a donné deux conférences à l'Université de Barcelone.

Avec Núria Vila, ma première étudiante de doctorat, nous lui avons exposé certaines difficultés qui avaient surgi lors de la résolution de problèmes de plongement galoisien. Son aide directe en cette occasion s'est traduite par une formule innovatrice, qui a permis de déterminer l'obstruction à la resolubilité du problème à partir d'une équation définissant l'extension initiale. Cette formule, une des ses questions sur la résolution effective des problèmes de plongement, et son appréciation postérieure d'une condition diophantienne issue des calculs, servirent à l'élaboration de

trois thèses, donnant lieu à la première ligne de recherche en théorie des nombres commencée dans l'Université de Barcelone. La formule obtenue par Serre, publiée dans son article *L'invariant de Witt de la forme* $Tr(x^2)$ [Oe 131, 1984], a constitué un point de référence de nombreux autres travaux, aussi bien d'ici qu'ailleurs.

Les articles et les ouvrages de Serre, et le matériel qu'il nous a transmis pendant plus de vingt ans, ont été indispensables pour entamer chez nous de nouvelles lignes de recherche, et ils ont contribué à mener à bon port des projets de recherche, des publications, ainsi qu'une bonne partie des quinze thèses en théorie des nombres qui ont été soutenues jusqu'à aujourd'hui dans notre université. De ce point de vue, je voudrais souligner ses articles sur la topologie des variétés algébriques en caractéristique p [Oe 38, Mexico 1958] ; sur la bonne réduction des variétés abeliennes [avec J. Tate; Oe 88, 1968]; sur les propriétés galoisiennes des points d'ordre fini des courbes elliptiques [Oe 94, 1972] ; sur les formes modulaires de poids 1 [avec P. Deligne; Oe 101, 1974]; sur les applications du théorème de densité de Chebotarev [Oe 125, 1981] ; et sur les représentations galoisiennes modulaires de degré 2 [Oe 143, 1987]. Actuellement, certaines de ces lignes de recherche sont poursuivies avec succès par des chercheurs formés par l'Université de Barcelone et exportés dans d'autres universités.

L'expérience mathématique comporte de nombreuses Ithaques, est pleine d'aventures, pleine de projets. Le Séminaire de Théorie des Nombres issu dans les années quatre-vingt de la collaboration de trois universités catalanes —l'Université de Barcelone, l'Université Autonome de Barcelone et l'Université Polytechnique de Catalogne— réunit aujourd'hui une trentaine de personnes. Les travaux de Serre ont été tout particulièrement importants dans les éditions suivantes : de 1986–1987, consacrée aux points rationnels des courbes algébriques ; de 1987–1988 consacrée aux conjectures de Serre sur les représentations de Galois de degré 2 ; de 1989–1990, consacrée aux structures de Hodge-Tate ; de 1992–1993, consacrée aux représentations de Galois de degré 2 ; de 1993–1994, introductrice au théorème de Fermat-Wiles ; de 1994–1995, consacrée aux formes modulaires et aux groupes de Galois, ainsi qu'aux points de torsion des courbes elliptiques ; de 1995–1996, consacrée aux courbes elliptiques modulaires ; et de 2003–2004, consacrée à l'étude des conjectures d'Artin, de Serre et de Fontaine-Mazur.

L'article [Oe 94, 1972], qui ouvre le volume III, est clé pour la compréhension des actions de Galois dans les objets arithmétiques géométriques ; une partie de sa base théorique est fournie par le cours, difficile, sur les représentations *l-adiques* que Serre a donné à McGill. Serre prouve dans ce travail que les groupes de Galois associés aux points d'ordre fini des courbes elliptiques sont « aussi gros que possible ». Le contrôle de l'action de l'inertie modérée devient essentielle ; celle-ci se fait par des produits de caractères fondamentaux aux exposants bornés.

L'article [Oe 143, 1987], dans le volume IV, est le fruit de sa connaissance profonde et vaste. Il a un précédent clair dans la conférence prononcée aux *Journées arithmétiques* de Bordeaux, douze ans auparavant. Ribet et Wiles ont obtenu leurs résultats grâce à un epsilon de la vision que le travail offre. Les conjectures précises de cet article sont aujourd'hui un objectif convoité de la recherche d'avant-garde. Comme le dit Mme la docteur Vila, « Serre a pu les formuler parce qu'il connaît bien *Serre tout entier* ».

La recherche mathématique catalane est une recherche jeune, sans tradition, qui a pris son envol au cours des dernières décennies en partant de la carence la plus absolue de textes mathématiques catalans ; sa langue de transmission habituelle est l'anglais. Diverses lignes de recherche contribuent à pallier ces manques. Pour notre part, la quasi-totalité des thèses en théorie des nombres ainsi que certains ouvrages ont été rédigés en catalan.

La recherche en théorie des nombres qui est effectuée à l'Université de Barcelone est transmise au professeur Serre de manière régulière et indépendamment de la langue qui y est utilisée. L'attention qu'il a bien voulu prêter à cette recherche, évidente dans certaines lettres et citations, a contribué de manière inestimable à sa diffusion et elle constitue pour nous un encouragement permanent. Personnellement, je ne connais aucune autre personne étrangère qui ait lu davantage de mathématiques en catalan que lui.

L'Université de Barcelone —fondée en 1450—, en concédant à Jean-Pierre Serre le titre de docteur *honoris causa*, se joint aujourd'hui aux universités de Cambridge (1978), Stockholm (1980), Glasgow (1983), Athènes (1996), Harvard (1998), Durham (2000), Londres (2001), Oslo (2002), Oxford (2003) et Bucarest (2004) qui, depuis 1978, se sont honorées en reconnaissant sa qualité scientifique et humaine.

Professeur Serre, merci.

Pilar Bayer
UB

Xavier Tolsa received a prize at 4ECM

Several prizes are awarded at the European mathematical congresses, held every four years, to young mathematicians in recognition of particularly relevant contributions. At the 2004 European Congress, held in Stockholm, a prize was awarded to Xavier Tolsa, an ICREA analyst attached to UAB. The only Catalan mathematician to have won such a prize before Xavier Tolsa is Ricardo Pérez-Marco, who was awarded his prize at the 1996 European Congress in Budapest for having solved several conjectures (by Arnold, Sad, Siegl, Moser and others) in dynamic systems. The work for which Tolsa was awarded the prize is an article [To1] published in the Swedish journal, *Acta Mathematica*, which is known as one of the best in the world. In this article he solves the problem of the semi-additivity of analytic capacity, posed in 1966 in an influential article by Vitushkin. The work is the brilliant culmination of a series of prior contributions by several mathematicians. David, Journée and Semmes (from the school of Yves Meyer, one of the creators of wavelet theory), Christ (Berkeley), Nazarov, Treil and Volberg (Saint Petersburg), Melnikov and Vitushkin (Moscow), Jones (Yale), Mattila (Helsinki) and Mateu and Verdera (Barcelona). Since one of Tolsa's main results can be expressed very easily in terms intelligible to any graduate, we provide it below.

The question involves analytical functions on the plane. Remember that Riemann showed that if a function f, analytic in a disc, except perhaps at its centre, has the property that the values of $f(z)$ are bounded as z approaches the centre, then f extends to a function analytic in the entire disc. Specifically, f has a continuous extension to the centre. This is a surprising fact that strongly depends on the analyticity and the dimension, and it is obvious that the real variable analogue does not hold: the function that takes the value 1 on the interval $(0,1)$ and 0 on the interval $(-1,0)$ does not extend continuously to 0. Painlevé, a French mathematician, studied the removable sets for bounded analytic functions in his doctoral thesis of 1888. These are the compact sets K of the plane, with the property that if we take an analytic function bounded at $\Omega \setminus K$, for any open Ω, then the function extends analytically to all Ω. Painlevé showed that every set of null Hausdorff length is removable. He thus gained a dimension over Riemann. There was considerable activity regarding the notion of removability in the first half of the last century until Ahlfors, a Finnish analyst of a strong geometric bent, asked in 1947 whether it was possible to find *geometric* characterisations of the removable sets and, in fact, called the question the Painlevé problem.

In his article (see also [MTV]), Xavier Tolsa showed that a compact K is not removable if and only if it is possible to construct a positive measure μ in K, not null, which has the following two properties:

1. For any disc D, the measure of the disc does not exceed the radius:

$$\mu(D) \leq \text{radi}(D).$$

2. If $R(z,w,\zeta)$ denotes the radius of the circumference that passes through points z, w and ζ, then

$$\int\int\int \frac{1}{R(z,w,\zeta)^2}\, d\mu(z) d\mu(w) d\mu(\zeta) < \infty.$$

Any reader will be able to see clues to the importance of the above result in the fact that removability is described in terms that no

longer refer to analyticity and that only involve real variable notions (measures) with geometric content (the radius $R(z, w, \zeta)$). We note, however, that it is, in principle, arguable whether the condition is geometric because it brings in the existence of a measure satisfying specific conditions. The real question is the following: is the above condition geometric in the precise sense that it is a bilipschitz invariant? Remember that a homeomorphism Φ of the plane is bilipschitz if it preserves distances modulo constants, i.e. if there exists a constant $C \geq 1$ such that:

$$C^{-1}|z-w| \leq |\Phi(z)-\Phi(w)| \leq C|z-w|, \ \ z, w \in \mathbb{C}.$$

Strong evidence was presented in [GV] that this had to be true and in [To2] the invariance of the removable sets in bilipschitz geometry was confirmed, in another excellent article. The Painlevé problem can therefore be considered solved and Mathematics has lost an open problem but gained a first-rate mathematician.

$$C^{-1}|z-w| \leq |\Phi(z)-\Phi(w)| \leq C|z-w|, \qquad z, w \in \mathbb{C}.$$

References

[GV] J. Garnett and J. Verdera, *Analytic capacity, bilipschitz maps and Cantor sets.* Math. Res. Lett. **10** (2003), vol. 4, 515–522.

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[To1] X. Tolsa, *Painleve's problem and the semi-additivity of analytic capacity,* Acta Math. **190** (2003), 105–149.

[To2] X. Tolsa, *Bilipschitz maps, analytic capacity and the Cauchy integral,* Ann. of Math. **162** (2005), 1243–1304.

Joan Verdera
UAB

Miguel de Guzmán, in memoriam

Miguel de Guzmán died suddenly in Madrid on April 14, 2004. Having had the privilege to have been his friend, I would like to share with the members of the Catalan Mathematical Society the memory of one who was undeniably a key figure in Spanish Mathematics and a good friend to Catalan mathematicians.

Miguel de Guzmán Ozámiz was born in Cartagena in 1936. He studied philosophy in Germany and Mathematics in Madrid and earned his doctorate in Chicago under the direction of Professor Calderón. He was Professor of Mathematical Analysis at the Complutense University of Madrid, a member of the Royal Academy of Sciences, Chairman of the International Commission for Mathematical Education (1991-1998) and a visiting lecturer in many countries. But apart from the details of his curriculum vitae, I would like to talk about him as a person. He was a friendly man with deep ethical convictions and a special love of his family and friends and was able to carry out intensive research into analysis and geometry while maintaining a tremendous vocation for education and the popularisation and promotion of everything surrounding the world of Mathematics. He was an extraordinarily well educated and highly trained man who devoted himself body and soul to transmitting his passion for Mathematics to the world. His goal was the future and he wanted to reserve in it a place of honour for his beloved discipline: new research subjects, the new generations that had to be trained, the social perspective that had to be improved, the progress of people, etc. He has left us trained people, articles, books and, above all, many memories with which to continue to promote his ideas.

His intense life as a lecturer, populariser and promoter of new initiatives has laid down milestones that today, in his eternal absence, serve as beacons.

He visited Catalonia many times to speak at congresses and conferences, as the author of books, as a member of doctoral thesis juries, etc.

Here he would find Albert Dou whom he so admired, some of his disciples, many lecturers with whom he collaborated and many friends and followers. His last visits were for the tribute in Girona to our own Lluís A. Santaló and for the inauguration at IEC headquarters of the programme for promoting mathematical talent —a programme he had led successfully in Madrid and which is now taking off in Catalonia.

Heaven has a new light. It is a star-shaped polyhedron and anyone looking at it will discover things there. It is him.

Thank you, Miguel Guzmán, for your example. We will never forget you.

Claudi Alsina i Català
UPC

Problem Section

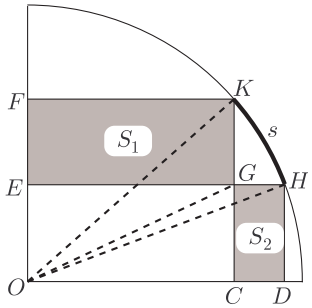
From the first issues of *SCM/Notícies*, one of the most popular sections of our Newsletter has been the Problem Section, where our readers can find and post mathematical questions and problems being either curious or interesting (or both). And, of course, they can also propose solutions to the problems announced in previous issues. For each issue, the editorial board chooses and publishes the nicest problems and the best solutions. As a sample, we reproduce three of the problems that appeared in this section.

Selection of posted problems with the corresponding solutions:

A52 *SCM/Notícies* 16, December 2001. (59th Annual William Lowell Putnam Mathematical Competition)

Let s be an arbitrary arc of the unit circle, situated at the first quadrant. Let A be the area of the trapezoidal region defined between the arc and the "x" axis, and let B be the area of the trapezoidal region defined between the arc and the "y" axis. Show that $A+B$ only depends on the length of the arc s and not on its position.

Solution: (Redaction)



Let S_1 be the area of the rectangle $EGKF$, and S_2 be the area of the rectangle $CDHG$. It is clear that $S_1 = 2 \cdot \text{Area}\,(\triangle OGK)$ because the triangle and the rectangle have the same basis and height. By the same reason, $S_2 = 2 \cdot \text{Area}\,(\triangle OGH)$. Hence,

$$\begin{aligned} A+B &= S_1 + S_2 + 2 \cdot \text{Area}\,(GHK) = \\ &= 2 \cdot (\text{Area}\,(\triangle OGK) \\ &\quad + \text{Area}\,(\triangle OGH) + \text{Area}\,(GHK)) = \\ &= 2 \cdot (\text{Area Sector}\,(OHK)) = \\ &= \text{Length of arc}\,(s). \end{aligned}$$

A59 *SCM/Notícies* 18, January 2003. (A german suggestion for an International Mathematical Olympiad)

Let a, b and m be integral numbers such that

$$\frac{a^2+b^2}{ab+1} = m \geq 0.$$

Show that, m is a square.

Solution: (Solution by Carles Romero, IES "Manuel Blancafort", La Garriga)

i) If one of the numbers is zero, the proposition is trivial.

ii) Assume $a = b$. Then we have:

$$0 \le m = \frac{2a^2}{a^2+1} \Longrightarrow 2a^2 = ma^2 + m$$
$$\Longrightarrow (2-m)a^2 = m \ge 0.$$

The only possibilities are $m = 0$ and $m = 1$, both being squares. The corresponding values for a are $a = 0$ and $a = \pm 1$, respectively.

iii) It is not possible that $a \neq 0$ and $b \neq 0$ have different signs, because $a^2 + b^2 > 0$ and so is $ab + 1 > 0$, hence $ab \ge 0$.

iv) Let us assume now $0 < a < b$. In this case,

$$b^2 - amb + a^2 - m = 0$$

is a degree two equation with respect to the unknown "b", having the given value of b as a solution. Let b' be the other solution (possibly equal to b). They satisfy

$$b + b' = am\,; \quad bb' = a^2 - m.$$

This is saying that if a and b produce the integer $m > 0$, then $b' = am - b$ and a also do. Hence, by (iii), $b' \ge 0$. Additionally, using $a < b$, we deduce that

$$ab' \le bb' = a^2 - m < a^2 \quad \Longrightarrow \quad b' < a.$$

Summarizing, if $0 < a < b$ produce the integer $m > 0$, then $0 \le b' < a$ also do.

v) Repeating the previous process several times, we obtain a strictly descending list of integral numbers, no two consecutive ones being of different sign. This implies that the list contains the zero. And immediately next to it there is the positive integer $\sqrt{m} = \text{m.c.d.}(a, b)$.

A63 *SCM/Notícies* 20, November 2004. (Proposed by Pelegrí Viader, Universitat Pompeu Fabra, Barcelona)

Let $f : [0, 1] \to \mathbb{R}$ be a continuous function such that $f(0) = f(1)$. Show that:

a) For every positive integer n there exists a *horizontal cord* of the graph of f having length $1/n$ (a *horizontal cord* is a segment between two points in the graph of f having the same second coordinate).

b) f does not necessarily have horizontal cords of length not being the inverse of a positive integer.

(*Theorem of the universal cord*)

Solution: (Solution by Albert Ferreiro Castilla, student)

The case $n = 1$ is trivial, by the hypothesis of the problem.

Suppose now $n > 1$. The problem consists on finding a pair of points, $0 \le x_1 \le 1$ and $0 \le x_2 \le 1$, in such a way that $|x_1 - x_2| = \frac{1}{n}$ and $f(x_1) = f(x_2)$. To show this, let us consider the following set of points in the real plain:

$$\mathcal{C}_n = \left\{ \left(x, x + \frac{1}{n} \right) \mid 0 \le x \le 1 - \frac{1}{n} \right\} \subset \mathbb{R}^2,$$

which is nothing else but the set of all pairs of real numbers between 0 and 1, and being exactly $\frac{1}{n}$ apart from each other (and ordered, first the small then the big one). Let us observe that this set $\mathcal{C}_n \subset \mathbb{R}^2$ is a segment of a straight line in the plane. Let us consider the following map, which is clearly continuous:

$$F : \mathcal{C}_n \to \mathbb{R}$$
$$F(x, y) = f(x) - f(y).$$

If we find $(x, y) \in \mathcal{C}_n$ with $F(x, y) = 0$, here we have the pair of points generating the cord of length $\frac{1}{n}$, and we are done. If we prove that, on the set $\mathcal{C}_n$, the map F takes simultaneously positive and negative values, then Bolzano's theorem will ensure us the existence of a zero, and we are also done. Let us assume that F has no zero (and so, does not take simultaneously positive and negative values), and we will find a contradiction.

Pick the pair $\left(0, \frac{1}{n}\right)$ from the set $\mathcal{C}_n$, and let us apply F. Since $F\left(0, \frac{1}{n}\right) \neq 0$, we can assume without lost of generality, that $F\left(0, \frac{1}{n}\right) > 0$.

Let us consider now the pair $\left(\frac{1}{n}, \frac{2}{n}\right)$: again by our assumption,

$$F\left(\frac{1}{n}, \frac{2}{n}\right) > 0.$$

Repeating the same argument, we can conclude that

$$F\left(\frac{i-1}{n}, \frac{i}{n}\right) > 0\,, \qquad i = 1, \ldots, n.$$

Putting all these inequalities together, we have:

$$F\left(0, \frac{1}{n}\right) > 0 \Rightarrow f(0) > f\left(\frac{1}{n}\right)$$
$$F\left(\frac{1}{n}, \frac{2}{n}\right) > 0 \Rightarrow f\left(\frac{1}{n}\right) > f\left(\frac{2}{n}\right)$$
$$\cdots$$
$$F\left(\frac{n-1}{n}, \frac{n}{n}\right) > 0 \Rightarrow$$
$$f\left(\frac{n-1}{n}\right) > f\left(\frac{n}{n}\right) = f(1)$$

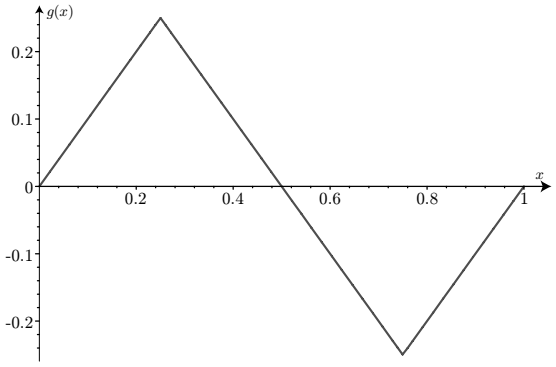
But then, $f(0) > f(1)$, which contradicts the hypothesis of the problem. Consequently, the map F is negative or zero on some the pairs in $\mathcal{C}_n$. Thus, we have the result. We remark the fact that we have been looking for points whose distance to each other is the inverse of a positive integer; this is essential sence, otherwise, the list of points obtained in the argument would not end at 1, which is what we need to contradict the hypothesis of the problem. That is, for lengths different from $1/n$ the given argument is no longer working.

Let us consider now the second part of the problem. The claim is obvious for the inverse of every number between 0 and 1: it is clear that no cord can exist with length $\frac{1}{0.5} = 2$ and this is not the interesting case. We shall construct an example concerning the inverse of a number bigger than 1:

Consider the following continuous function on the interval $[0, 1]$:

$$g(x) = \begin{cases} x\,, & \text{si } 0 \le x \le \frac{1}{4} \\ -x + \frac{1}{2}\,, & \text{si } \frac{1}{4} \le x \le \frac{3}{4} \\ x - 1\,, & \text{si } \frac{3}{4} \le x \le 1 \end{cases}$$

It clearly satisfies $g(0) = g(1) = 0$. So the hypothesis hold, but there are no cords of length bigger than $\frac{1}{2}$ (see the graph of g).



Mathematics PhD theses in Catalonia

Mathematics PhD theses in Catalonia

Three of the Catalan universities offer Mathematics courses, both at undergraduate and at doctorate level. The Faculty of Mathematics of University of Barcelona, the Faculty of Sciences of the Autonomous University of Barcelona and the Faculty of Mathematics and Statistics of the Technical University of Catalonia all have their corresponding doctoral programmes in Mathematics, in which doctors receive ongoing training in the different areas and specialities represented in Catalonia.

The quality of these doctoral programmes has increased considerably in recent years and is currently comparable to that of many of the best European and American universities. The outgoing students are fully initiated and ready to carry out research in their corresponding specialities, as shown by the fact that many of them participate actively in research groups both here and abroad and successfully devote themselves to mathematical research. Furthermore, following the trend of the most prestigious universities, there is a growing interest on the part of companies in the technology and financial sectors in hiring increasing numbers of doctors in Mathematics in order to develop their more specialised work. This is a clear indication of the vitality of our three doctoral programmes and of the usefulness of high-level Mathematics, beyond the realm of pure research.

To give an idea of the subjects dealt with

in the different doctoral theses of recent years, we provide a list of the titles, doctoral students and thesis directors that have been mentioned in *SCM/Notícies* since Number 18. For more information, see the corresponding issue of the journal or contact the coordinators of the corresponding doctoral programme:

- *Evolution of sex-ratio in structured population dynamics*, defended on October 5th, 2005 by Jordi Ripoll i Missé and directed by Àngel Calsina i Ballesta at the University of Barcelona.
- *Hermeneutics of the diferential calculus in the Europe of the XVIII century: from the Analyse des infiniment petits de L'Hôpital (1696) to Traité élémentaire de calcul diffírentiel et de calcul intégral de Lacroix (1802)*, defended on October 28th, 2004 by Mónica Blanco Abellán and directed by Josep Pla i Carrera at the University of Barcelona and Autònoma de Barcelona.
- *Localization and preservation of structures in stable homotopy,* defended on September 10th, 2004 by Javier J. Gutiérrez Marín and directed by Carles Casacuberta at the University of Barcelona.
- *Consecutive and statistic motives in restricted permutations,* defended on July 16th, 2004 by Sergi Elizalde Torrent and directed by Marc Noy Serano at the Technical University of Catalonia.
- *Reducibility of quasi-periodic skew-products and the spectrum of Schrödinger operators,* defended on June 22th, 2004 by Joaquim Puig i Sadurní and directed by Carles Simó i Torres at the University of Barcelona.
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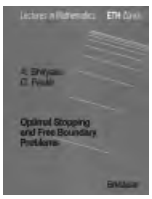

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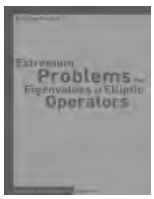

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