

Mathematics in Barcelona: Time Past, Time Future

Allyn Jackson

Barcelona is known for its great weather, arresting architecture, and excellent seafood. But this city, the site of the European Congress of Mathematics to be held in July of this year, is not just another pretty conference town. With four universities, an international center for mathematics research, hundreds of mathematicians, and thousands of students, Barcelona's mathematical community bustles in tune with the city's famed avenue of shopping and street artists, Las Ramblas. It is a community in transition, one that still bears the marks of its country's turbulent history but is nevertheless looking resolutely to the future.

The Marks of the Past

Mathematically, Spain is in many respects a developing country. Part of the lack of development has to do with Spanish culture, which tends to emphasize arts and humanities over science and mathematics. Other influences can be found in Spain's history, including the Spanish Inquisition and its suppression of scientific ideas. A more recent influence was the Fascist dictatorship of Francisco Franco, which began after the Spanish Civil War (1936–39) and lasted until his death in 1975. Franco controlled the press and many other institutions, including universities. Although Spanish science did not thrive in this climate, the Franco regime was not inimical to science; for example, it was only months after Franco took power that he established the Consejo Superior de Investigaciones Científicas (CSIC, Higher Council for Scientific Research), which today remains an important sponsor of research in Spain. Under CSIC in Franco's time, there was funding for mathematics research. However, it tended to accumulate around those having influential connections rather than around the best researchers.

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This is the general problem that has stunted the development of science and mathematics in Spain in this century: connections and the ability to maneuver within the system have been rewarded more than research excellence. A good example of this effect is the career of the Catalan mathematician Ferran Sunyer i Balaguer, who lived from 1912 to 1967.¹ Sunyer suffered from a congenital nervous atrophy, which confined him to a wheelchair and left him unable to write and able to speak only with difficulty. Despite his disability he taught himself mathematics and made a number of original contributions to research, particularly in classical analysis. His work was recognized internationally, and he had contacts with some of the most important mathematicians of his day, including Jacques Hadamard, Szolem Mandelbrojt, and Waclaw Sierpiński.

Although on the international scene Sunyer was one of the most important mathematicians in Spain, he lacked recognition within his own country. He earned a position at the CSIC only late in life, and despite working for a number of Spanish mathematics journals he was never asked to join their editorial boards. His life exemplifies the saying, common in academic circles in Spain, that one must be dead before one is recognized by one's colleagues. Indeed, Sunyer's name may be better known today than when he was alive, in part because of the establishment by the Institut d'Estudis Catalans of the Ferran Sunyer i Balaguer Prize, an annual award of 10,000 euros (about \$9,850) recognizing an outstanding mathematical research monograph. Sunyer's difficulties were also compounded by the fact that he was an open Catalan nationalist. Franco

¹*An excellent account of his life is "Ferran Sunyer i Balaguer (1912–1967) and Spanish Mathematics after the Civil War", by Antoni Malet (Mathematical Intelligencer 20 (2) (1998)). Malet has also written, in Catalan, a biography of Sunyer, which was published in 1995 by the Catalan Mathematical Society and the Catalan Society for the History of Science.*

perceived Catalan nationalism as one of the biggest threats to his regime, and in an effort to root out Catalan culture he forbade any official use of the Catalan language.

Many things have changed in Spain since Franco's death. The Generalitat de Catalunya was established as an autonomous government of Catalonia, and there followed a great revival of Catalan language and culture. In Catalonia and the rest of Spain, universities are now better funded, have more independence from the government, and are building research strength. Mathematics in particular is flowering in many places in Spain, including Barcelona. Sebastià Xambó, president of the Societat Catalana de Matemàtiques (Catalan Mathematical Society, SCM), noted that in the past twenty-five years mathematical research in Spain has gone from nearly zero to a reasonable international standard today. Holding the European Congress of Mathematics in Barcelona, he said, "gives us a good opportunity to symbolize this stage in a public event."

A Mathematical Society, a Mathematical Center

One of Catalonia's most famous native sons is the architect Antoni Gaudí (1852–1926), whose designs have become emblems of Barcelona. The free-form, undulating surfaces of his buildings look almost as if they had been molded into shape by human hands. At first glance his designs appear to have little of the symmetry and geometric form that typically connect mathematics and architecture. However, the mathematics simply lies deeper. For example, in his great unfinished work, the Sagrada Família (Sacred Family) church, many of the fluid shapes are created using ruled surfaces, particularly the ruled hyperboloid, a shape often found in nature. Gaudí also developed a highly geometric method of using regular polygons to generate the shapes for the church's columns. Gaudí died in 1926, when only one of the church's four 100-meter parabolic towers had been finished (eight more spires have yet to be built; the highest will soar 130 meters). During the Spanish Civil War vandals burned the drawings for the church and smashed many of the models. Despite this loss, construction of the church continues, and the mathematical aspects of his designs have facilitated the use of computers to generate new models from which the builders can work. During the European Congress there will be organized tours of the church, emphasizing the mathematical elements of Gaudí's work.

The Catalan affinity for architecture can also be seen in a remarkable fifteenth-century building in Barcelona's Gothic quarter, a building that is home to the National Catalan Library, as well as to the Institut d'Estudis Catalans (Institute of Catalan Studies, IEC). Originally a convalescent home, the building features elaborate tiled wainscoting and

a sculpture of Saint Paul in its courtyard. The building is currently undergoing massive renovations, which should be complete by the time of the European Congress. Founded in 1907, the IEC is the central custodian of Catalan language, history, and culture. During the Franco regime, the IEC was mostly dormant, though some of its members continued to meet clandestinely in private homes. Funded by the Generalitat, the IEC today is Catalonia's main scholarly academy for all areas, from the humanities to the sciences. The current institute president is Manuel Castellet, one of the four members of the IEC's mathematics section. The IEC oversees two important institutions on the mathematical scene in Barcelona: the SCM and the Centre de Recerca Matemàtica (Mathematical Research Center).

SCM president Sebastià Xambó is a busy man: He is a full professor of mathematics at the Universitat Politècnica de Catalunya, vice rector of that institution, and chair of the executive committee of the European Congress. Since Xambó became president in 1995 the SCM has grown from around 400 members to nearly 1,000. Xambó credits the expansion in part to the interest surrounding the Congress, of which the SCM is the sponsoring society. The growth of the SCM came at a time when Spain's main national mathematical society, the Real Sociedad Matemática Española (Royal Spanish Mathematical Society), was relatively inactive. The SCM has been especially visible on the European scene: it was one of the first organizations to join the European Mathematical Society when the EMS was founded in 1990, and in 1996 it put in its successful bid to hold the 2000 European Congress in Barcelona (bids are made by mathematical societies rather than by nations).

The SCM publishes a research journal, *Butlletí de la Societat Catalana de Matemàtiques*, and a news publication, *Notícies*. The society is in many ways resolutely Catalan: for example, it recently published translations into Catalan of Gauss's *Disquisitiones Arithmeticae*, beautifully bound and printed on high-quality paper, and of René Descartes's *La Géométrie*, extensively annotated with explanations in modern terminology. The SCM also holds meetings, the most



Photograph courtesy of Allyn Jackson.

Sebastià Xambó (left), president of the Catalan Mathematical Society, and Manuel Castellet, director of the Centre de Recerca Matemàtica. They are standing in the courtyard of the Institut d'Estudis Catalans, of which Castellet also serves as president.

The Barcelona Congress

The European Congress of Mathematics (ECM) is held every four years in a city in Europe. The third ECM will take place July 10 to 14, 2000, in Barcelona. The congress is organized by the Catalan Mathematical Society, under the auspices of the European Mathematical Society (EMS). The International Mathematical Union has designated the Barcelona congress as a World Mathematical Year 2000 event.

The ECM scientific program features nine 1-hour plenary lectures and thirty 50-minute parallel-session lectures. Ten minisymposia, lasting four and a half hours apiece, will focus on emerging topics that have important interactions with areas outside of mathematics. As at the previous two ECMs—in Paris in 1992 and in Budapest in 1996—several “round table” sessions will explore issues such as education and public awareness of mathematics. Demonstrations of mathematical software and video exhibitions are also planned.

At the opening ceremonies up to ten EMS Prizes will be given to recognize outstanding research by European mathematicians under the age of thirty-two. In addition, the first Felix Klein Prize will be awarded to a young researcher or to a small group for using sophisticated methods to give a solution to a concrete and difficult industrial problem.

The ECM organizers say they expect about 1,500 participants. Because of the complications of holding such a large meeting at a university and because the universities lack an auditorium large enough for the plenary lectures, the organizers opted to hold the ECM at the Palau de Congressos, Barcelona’s main convention center. From there, a short subway ride takes one to the old center of the city or to the universities. Participants will be housed in hotels or university dormitories that are either near the congress site or easily accessible by public transportation.

Funding for the congress comes from the government of Catalonia and the central Spanish government, and from the city of Barcelona, the universities, the Institut d’Estudis Catalans, the International Mathematical Union, and private companies. Beverages will be donated by Codorníu, one of the top makers of *cava*, the Spanish counterpart of champagne.

—A. J.

ECM Web Sites:

<http://www.iec.es/3ecm/>

or

<http://www.si.upc.es/3ecm/>

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recent one being the third *Trobada Matemàtica*, or Mathematical Meeting, held in March 2000, which brought together around fifty Catalan mathematicians for a program of five lectures.

Xambó is an enthusiastic promoter of all SCM activities, but what seems closest to his heart are the SCM’s two programs for young people. The first, which is in fact the oldest program of the SCM, is the organization in Catalonia of a phase of the Mathematical Olympiad. The second, begun in 1996, is a less exclusive and more playful rendition of the Olympiad called Cangur. Originally started in Australia and later transplanted to France under the name Kangaroo (“cangur” means kangaroo in Catalan), the competition spread around Europe, where it is sometimes also called the Mathematical Feast. Cangur aims to capture the interest of a wide range of students, not just those with special mathematical talent. When the SCM started Cangur, it drew 1,500 participants; this year over 5,000 students are expected to take part across all of Catalonia. In addition to promoting mathematics among students, Cangur has provided a connection between SCM and teachers in secondary schools.

The Centre de Recerca Matemàtica (CRM) has the distinction of being Spain’s only international mathematics research center. Manuel Castellet has served as the director since founding the center in 1984. He received his Ph.D. from the Eidgenössische Technische Hochschule in Zürich in the 1970s as a student of Beno Eckmann, the founder of the Forschungsinstitut für Mathematik (Mathematics Research Institute) of the ETH. Castellet returned to Spain in 1976 to take a position at the Universitat Autònoma de Barcelona, and in 1982 he organized the first Barcelona Conference on Algebraic Topology and invited some of the top international researchers. Two years later, influenced by the Zürich institute and wanting to expand further the international contacts available to mathematicians in Barcelona, Castellet founded the CRM as a center under the IEC.

The CRM is a visitors’ institute, in the sense that it has no permanent faculty, apart from the director. Visitor stays range from one month to a year, or sometimes two years for postdoctoral researchers. Each year there are eight or nine visitors who stay for longer than six months and about sixty who stay for shorter periods. Specific areas of emphasis are chosen for the fall and the spring semesters; for the academic year 1999–2000 these were differential geometry and dynamical systems. Because of Castellet’s own interests and the strength of the research group in algebraic topology that has grown at the Autònoma, the CRM has historically been especially strong in this area. In coordination with the Barcelona Conference on Algebraic Topology, which now takes place every four years, the CRM organizes a semester emphasis in that subject. Five years ago the CRM

started a series of advanced courses in mathematics that last one to two weeks and feature lectures by two experts in an area that has seen recent developments. Course topics have included mathematical aspects of image processing and integral geometry (1999) and algebraic aspects of quantum groups (2000).

The CRM is located in the mathematics building of the Autònoma, a thirty-minute commuter train ride from the center of Barcelona. Renovated in 1994, the CRM quarters are elegant and comfortable, with excellent office and lecture facilities. The center is a tremendous asset for mathematicians in Catalonia, and especially for those at the Autònoma, for whom CRM activities and visitors are just down the hall. In addition, the Autònoma mathematics department can rely on the CRM staff for logistical help when inviting visitors. Indeed, a substantial amount of the activity of the CRM has had ties to the Autònoma mathematics department. The CRM, being a part of the IEC, is a resource for all Catalan mathematicians. However, some believe that the lion's share of advantages accrue to mathematicians at the Autònoma. In addition, although there seems to be general agreement about the high quality of the

CRM research activities, some would like to see the center distribute its activities more evenly across the full range of mathematical areas.

Such concerns, together with a desire to enhance support for research, have led mathematicians at the Universitat de Barcelona to launch their own mathematics research institute. Early this year they received approval and a small amount of start-up funding from the university to establish the Institut de Matemàtica de la Universitat de Barcelona (IMUB). The main purpose of the IMUB is to increase the research strength of the university's mathematics faculty by bringing in visitors and postdocs. The IMUB will likely bear some similarity to the CRM; for example, plans call for the IMUB to choose areas of emphasis for each semester and to offer advanced courses. Some have wondered whether Barcelona ought to have two mathematics institutes. The CRM receives steady funding from the Generalitat, making up about 30 percent of the center's budget; the rest comes from grants requiring yearly applications. As the IMUB gets under way, the two institutes might find themselves competing for the same funds.

Four Universities, Nine Mathematics Departments

The heart of Barcelona is Las Ramblas, a long avenue that runs from the harbor to the Plaça de Catalunya and has a central pedestrian island suited to strolling. Every hundred meters or so one finds a street performer: a foot-tall puppet convincingly plays Beethoven, fingers flying and arms flailing, on a pint-sized piano; a mime dressed as a cowboy and bathed head to toe in bronze makeup looks like a sculpture with a fine patina. Here one also finds high art, in the form of the Gran Teatre del Liceu, Spain's primary opera house, which reopened last fall after a 1994 fire gutted the auditorium and stage. Another form of entertainment is the Boqueria, Barcelona's central market, featuring an extraordinary variety of sea creatures, from staples like salmon and prawns to local specialties like *espadenyes*, a kind of sea cucumber.

A left turn at the Plaça de Catalunya and a five-minute walk takes one to the regal main building of the Universitat de Barcelona (UB). The building dates from 1871, but the university was founded in 1450. With 74,000 students, a little less than half the total in Catalonia, UB is the state's largest university and the second largest in all of Spain. A little farther out from the historic center of the city is the Universitat Politècnica de Catalunya (UPC), which is primarily an engineering school. The UPC was founded in 1971 when two engineering schools and an architecture school united, but the mathematics faculty was established only later, in 1992. Today the UPC has around 28,000 students. Also founded in the 1970s was the Universitat Autònoma de Barcelona (UAB), which has around

Third European Congress of Mathematics Plenary Lecturers

Robbert Dijkgraaf
Universiteit van Amsterdam

Hans Föllmer
Humboldt-Universität, Berlin

Hendrik W. Lenstra Jr.
University of California, Berkeley,
and Universiteit Leiden

Yuri I. Manin
Max-Planck-Institut für Mathematik, Bonn

Yves Meyer
École Normale Supérieure de Cachan

Carles Simó
Universitat de Barcelona

Marie-France Vignéras
Université de Paris 7

Oleg Viro
Uppsala Universitet and
POMI, St. Petersburg

Andrew J. Wiles
Princeton University

45,000 students. Situated in the Barcelona suburb of Bellaterra, the UAB is the only one of Barcelona's universities that has an American-style campus. Back in the center of Barcelona one finds the city's newest university, Universitat Pompeu Fabra (UPF); founded in 1990, it has only 7,000 students and six departments. UPF has no mathematics department, but there are some mathematicians in the Department of Economics and Business. The growth of universities in Barcelona is part of a general university expansion across Spain, which began in the 1970s and seems now to be ending.

In Spain professorships in mathematics always come with a specific area designation, such as algebra, analysis, or geometry. In many cases whole departments grow up around these areas. At the UB there are four departments under the Faculty of Mathematics: the departments of applied mathematics and analysis, of probability and statistics, of algebra and geometry, and of logic and the history of science. Each department has responsibility for organizing and teaching all courses within its specialty. At UPC, mathematics teaching is organized in coordination with engineering disciplines.

For example, the Applied Mathematics I Department specializes in teaching mathematics for industrial engineering students. Similar teaching specialties are found in the other three departments: Applied Mathematics II, Applied Mathematics III, and Applied Mathematics and Telematics. These departments also have clusters of people who share research specialties, some of which are unrelated to the engineering specialties they serve. The UAB is the only one of the three having a single department that organizes the teaching of mathematics courses across all specialties, so that, for example, a professor of algebra might teach a course in analysis.

The division of mathematics into several departments at the UB and the UPC strikes some, including many mathematicians at those institutions, as fragmented. But changes do not seem to be on the horizon. For one thing, habit and tradition die hard. One observer also noted that this structure tends to create "small parcels of power" that faculty cling to. In addition, the level of teaching specialization provides a measure of security to faculties that have become quite large: The UPC

and the UB each have about 100 professors. The UPC mathematicians can argue that they need many professors to provide teaching tailor-made for engineering specialties; their own undergraduate program in mathematics is small and selective, with only 200–250 students. The UB offers about seventy courses, some of them quite specialized, to its 1,000 mathematics students. The mathematics department at the UAB, with about 60 professors and around 400 students, offers around fifty such courses.

All three universities did a lot of hiring in mathematics in recent years and have now reached capacity in numbers of professors. A crisis may be looming on the horizon, for the number of mathematics majors has been declining. The number of first-year undergraduate students in mathematics at the UB fell in recent years from 300 to 200; at the UAB the numbers went from around 100 to around 80. (The UPC mathematics program has been somewhat sheltered from this problem, because since its inception it has accepted only about 50 students per year.) One reason for the decline seems to boil down to job prospects: Spanish companies do not have a tradition of hiring mathematicians. Companies in Catalonia tend to be branches of multinationals whose research laboratories are outside of Spain. Therefore, companies' appreciation for theoretical training is not as high as one finds in, say, Germany.

Barcelona mathematicians are working on ways to address these problems. For instance, Joaquim Bruna, chair of the mathematics department at the UAB, has begun a program of soliciting consulting work from local industry. An example is a project from a casino in Catalonia, which wanted to be sure that its card-shuffling machines were mixing the cards sufficiently; UAB mathematicians concluded they were. The connections to industry have led the mathematics department to establish new degree programs in industrial mathematics and in mathematical finance, the latter jointly organized with the CRM and supported by the Catalan Stock Exchange. At the UPC the curriculum for the mathematics degree program has a distinctly applied flavor and is oriented toward training students for positions in industry. Pere Pascual, head of the UPC mathematics faculty, said UPC mathematicians are working on strengthening ties to industry and are making concerted efforts to see that their students get jobs.

The decline in numbers of undergraduate mathematics students also does not bode well for doctoral programs. For the academic year 1999–2000, the number of first-year mathematics Ph.D. students is 14 at the UB, 9 at the UAB, and 20 at the UPC. These numbers are quite small, considering that there are around 300 mathematics professors across the three universities. The main reason for the low numbers is the weak academic job



Photograph courtesy of Allyn Jackson.

The main building of the Universitat de Barcelona, where the mathematics faculty is located.

market. In Barcelona the normal career path for a mathematician is to get a tenured job at the same institution where he or she received the Ph.D. With the Barcelona mathematics faculties full of young, recently hired professors, this career path looks quite bleak. Lackluster academic job markets in the rest of Spain, in Europe, and in the United States face those who consider taking jobs outside Barcelona. Another problem is that professors in Spain are not well paid, and students find that they can make higher salaries in a different occupation with only a bachelor's degree in mathematics.

Bruna noted that while the level of mathematical research in Barcelona is such that one can do a very good Ph.D. there, the research groups tend to be quite specialized. During the expansion of Spanish universities such a Ph.D. was in demand, but no longer. In industry such a degree is seen as too specialized and insufficiently practical. For this to change, said Bruna, "the mentality must change, in universities and in industry."

The Promise of the Future

Barcelona's hosting of the 1992 Summer Olympics provided impetus for a major revamping of the city's infrastructure. New buildings were erected and others renovated in the construction of the Olympic Ring atop Montjuïc, the highest point in Barcelona, with a commanding view of the city and the sea. One of the creations was a sleek white telecommunications tower overlooking the esplanade of the Olympic Ring. The tower was designed by Santiago Calatrava, a Valencian whose fluidly curved creations have made him one of today's most original and sought-after architects. The main column of the 136-meter tower is set at a precise angle so that on the summer solstice sunlight travels the entire length of the column to hit the pavement below. A silhouette image of Calatrava Tower symbolizes the city in the logo for the European Congress of Mathematics. In choosing such a modern image, the Congress organizers are indicating that the purpose of the meeting is to look resolutely to the future and not to the past.

Calatrava Tower is just barely visible from the office of Andreu Mas-Colell, commissioner for universities and research in the Generalitat. Mas-Colell, one of the world's leading mathematical economists, held a joint appointment in mathematics and economics at the University of California, Berkeley, before moving to Harvard University in the early 1980s. In 1995 he returned to his native Barcelona to lead the Department of Economics and Business at the Universitat Pompeu Fabra, which has gained the reputation of being Barcelona's elite university. During his time at Pompeu Fabra, Mas-Colell built up an economics faculty that today counts among the best in Europe.

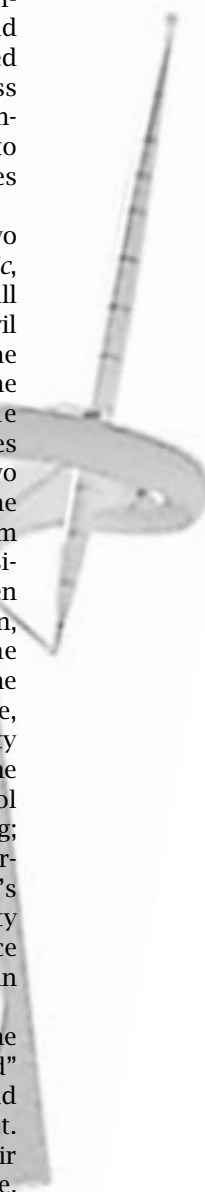
This success is due to Mas-Colell's international stature, but also to the fact that he started essen-

tially from scratch. He was thus able to avoid what is probably the biggest obstacle to improving scientific and mathematical research in Spain: the inbred nature of the professoriate. In Barcelona's mathematics departments, not only is it rare to find any non-Spaniards, there are only a few non-Catalans. Many mathematicians in Barcelona hold jobs at the same institutions where they received their Ph.D.'s. This is a common situation across Spain and has much to do with Spaniards' attachment to their hometowns and their reluctance to move, even within Spain. But the real problem lies in the hiring system.

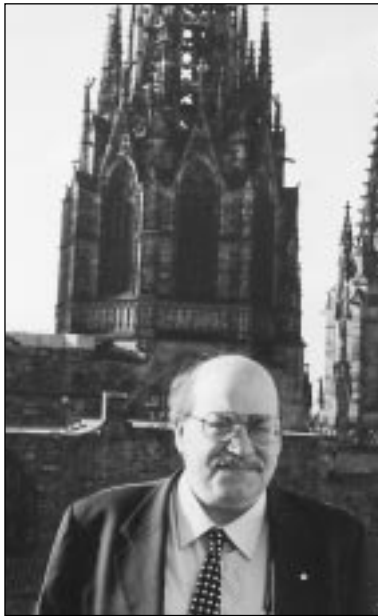
In Spanish universities there are basically two kinds of tenured positions, *Titular* and *Catedrático*, which are roughly equivalent to associate and full professor respectively. The fact that these are civil servant positions meant for a long time that one had to be Spanish to apply for them; today one need only be a citizen of a nation in the European Community. When a position becomes vacant, a hiring jury is formed, consisting of two representatives from the university offering the position and three others chosen randomly from among mathematicians at other Spanish universities who are in the same research area as the open position. In principle, the hiring process is open, and there is plenty of external advice to the university doing the hiring. "De facto, it is just the reverse," said Mas-Colell. "When I say the reverse, I mean 100 percent the reverse." University faculty watch for such openings in the hope of placing one of their students. They also have some control over the timing and placement of the advertising; sometimes nontenured assistantships are advertised only in local newspapers and with a week's notice before the deadline. The two university representatives on the jury can usually influence one of the three external members in order to gain a majority.

If one asks Barcelona mathematicians about the hiring system, the descriptions range from "bad" to "terrible". Everyone seems to dislike it, and everyone seems to feel powerless to change it. There are a few individuals who take steps on their own to work against the system—for example, Joaquim Bruna of the UAB refuses to serve on the jury of a position for which one of his students is being considered—but they are the exceptions. The current system, established in 1986, bears some resemblance to the Franco-era system, which suffered from some of the same problems but which some believe was actually fairer. But perhaps the problems arise not out of the system itself but out of the way in which the system is used: it serves to reward those who can pull the right strings rather than to find the highest-quality candidates.

Still, said Mas-Colell, "slowly, slowly the system is changing." Pompeu Fabra successfully developed a tenure-track system, and Mas-Colell noted



The Calatrava Tower.



Andreu Mas-Colell, commissioner for universities and research in the Catalan government, on a terrace outside his office in central Barcelona.

that other universities are moving in this direction. He is also trying to stimulate change through a couple of new government programs. In one, the Generalitat will help universities to fund positions for people whom the universities can demonstrate are chosen in an open, external review. As Mas-Colell described it, the program “gives universities incentives to come up with excellent candidates.” In another program, thirty scholars across all fields will be chosen each year to receive special grants running four to six years. One possible use of the funds is to buy out the scholars’ teaching time, freeing them up to concentrate on research. A program initiated not by the Generalitat but by the Spanish government will create over the next three or

four years about 2,000 research-only positions across Spain. These positions will function in a similar way to those of France’s CNRS (Centre National de la Recherche Scientifique), except that the Spanish positions will have limited durations, at most eight to ten years. Mas-Colell said that he expects 300 to 400 of these positions to go to scholars in Catalonia.

While inbreeding has hindered the development of mathematical research in Barcelona, it has not stopped it. Indeed, across the city’s universities one can find many groups doing excellent work. For example, David Nualart and Marta Sanz at the UB lead a group of about fifteen professors and students in stochastic analysis, the only group in Spain actively working in this area. The group’s research is quite theoretical, focusing mainly on the study of stochastic partial differential equations and applications of Malliavin calculus. The group has many ties to researchers in similar areas in other countries, particularly France. It is also a node on the network “Stochastic Analysis and Its Applications”, funded by the European Community, which encourages collaborations mainly through exchanges of postdocs. Last

year David Nualart received one of the highest honors in science and technology in Spain, the Iberdrola Prize, which is given by the Iberdrola electrical power company. The prize carries a monetary award of 12 million pesetas (about \$71,000).

Nualart and Sanz both got their Ph.D.’s at the UB in the 1970s. At that time there was very little research, and they had to find their own way in building their research group. The situation of their UB colleague Carles Simó is similar: he did a doctorate in celestial mechanics at the UB in the early 1970s. Together with Amadeo Delshams at the UPC, Simó now leads a dynamical systems group of about thirty-five people at the two universities. A prodigious worker, Simó holds a three-hour seminar each week and has been known to give courses that meet for six hours in a single day. His research exemplifies the can-do spirit of Barcelona mathematicians, bringing in tools from all across mathematics and beyond to bear on questions in dynamical systems. If the right tools do not exist, the group tries to build them. Needing serious computing power for a simulation, they built their own supercomputer on a shoestring by networking in parallel eighty-four Pentium 500 processors. Simó has also worked on many applications of dynamical systems, including projects for the European Space Agency and the Jet Propulsion Laboratory.

Three mathematicians from Barcelona will speak at the European Congress of Mathematics: Simó will give a plenary lecture, and Joaquim Bruna of the UAB and Xavier Cabré of the UPC will speak in parallel sessions. The ECM speakers were chosen by a scientific committee that was appointed by the European Mathematical Society and has representatives from all across the continent. The fact that there are three locals among the invited speakers (out of a total of almost forty) is an indication of how well Barcelona mathematicians hold their own in a major international meeting like the ECM.

For Marta Sanz, who serves as the secretary of the executive committee of the ECM, the Barcelona Congress represents a “normalization” of mathematical relations between Spain and the rest of Europe and the world. Mathematics in Spain still bears the burdens of what the Catalan science historian Antoni Malet called “the peculiar country that kept alive the last dictatorship of Western Europe.” But those burdens are slowly being shed. Today mathematics in Spain is growing, and the European Congress provides a way to celebrate this achievement. In holding the ECM in Barcelona, said Sanz, “There is a general feeling that we are doing something important for the development of mathematics in our country.”

About the Cover

Ceramic tile walls in the “galeria” entrance to the Institut d’Estudis Catalans (Institute of Catalan Studies) in Barcelona. The fifteenth-century building is a former convalescent home. Photograph courtesy of the Institut d’Estudis Catalans. Photographer: Manuel Armengol.



—Sandra Frost