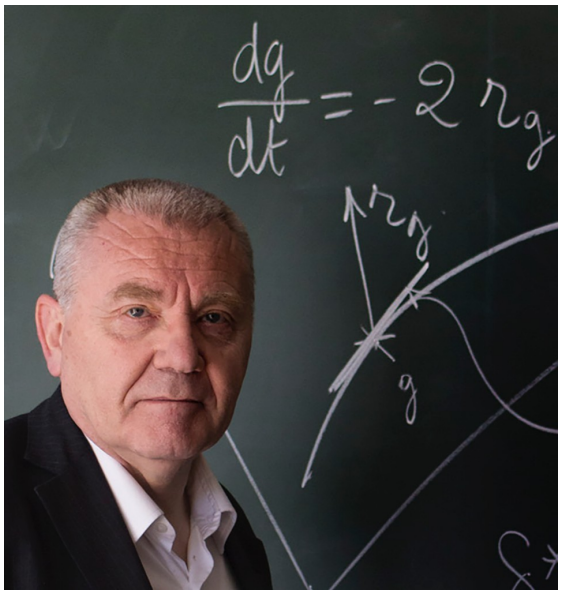
Interview with Jean-Pierre Bourguignon

A slightly edited version of an interview that was conducted by videoconference on 24 January 2024

Martin Raussen



Jean-Pierre Bourguignon. (Photo: Jean-François Dars)

Martin Raussen: *Dear Professor Bourguignon, this interview will focus on your relations to European mathematics. You were the 2nd president of the European Mathematical Society in the period 1995–1998, succeeding Professor Friedrich Hirzebruch. But let us start with yourself and your career as a mathematician.*

School and mentors

MR: *You were born two years after the end of WW2 in Lyon in France. When did your particular interest in mathematical topics and questions arise? Did that already happen in school? Do you have any special recollections from that time?*

Jean-Pierre Bourguignon: Thank you for the opportunity to talk about my personal life. As you said, I was born two years after the war. My father had been a prisoner of war in Germany for five years, and that was of course a very important moment in his life.

He came from a poor peasant family where everybody had to work, and he couldn't even finish primary school normally, although he managed to get what is called in France the *Certificat d'études primaires*. My mother had better conditions and could go to school all the way. For both of them, it was very important to give their children the possibility to study.

My father had been very frustrated not to be able to learn more. Actually, after having been a prisoner of war he wanted his children to speak German because he felt that sharing a language is the first point of contact between people. From his time as a prisoner, he did not come back anti-German, but strongly anti-Nazi. So, I do speak German, because my father wanted that; German has been the first language I studied at school.

For my education, and that of my classmates, it has been very important that we attended the same school, Lycée Ampère Saxe in Lyon, for many years: from primary school to secondary school, what we now call *"le collège"* in France, and then the first two years of grammar school (*lycée*). I must say that I found school extremely enjoyable, because of the exceptional quality of the teachers. In primary schools in France, one teacher takes care of all subjects. As soon as you get to *collège*, you have specific teachers for specific subjects. I had the same mathematics teacher in *collège* for three years out of four and again the first two years of *lycée*. He was not a great mathematician, although he was very competent, and strict. He used the pupils who had no problem with mathematics to help the other ones. Having to explain mathematics to others is a very good way to deepen your understanding, almost without noticing it.

At the time, I was not especially interested in mathematics. I was doing well in almost every subject, in Latin, in French; I got very good grades in all fields. Actually, in the *lycée* I was much more interested in literature or philosophy. I read quite difficult philosophical books already when I was 14 or 15, because I found this much more challenging than mathematics. I learned mathematics without effort and got good grades, but I was not passionate about it. The same with physics, by the way. I didn't really work much. I was certainly very attentive during class. I don't remember working for school after dinner. In my family, everybody would go to bed at 9 p.m., as my father got up every day at 4.30 a.m.

to go to work at the post office, and we were living in a small apartment.

A big change arose in the last year of high school. I had to move from where I had studied for so long to the main building of Lycée Ampère in the centre of Lyon. The mathematics teacher I had there was not very good from the pedagogical point of view, but he was passionate about mathematics and astronomy. His course was difficult to understand. You had the feeling that he was really telling you something deep and interesting, even if you couldn't get it. This was not very good for getting a good grade at the *baccalauréat* (French high school diploma). It gave me the urge that I had to understand what he told us. Consequently, this teacher induced me to work by myself. I tried to find books where I could really get an idea of what was going on in his class.

At the same time, since I had very good grades before, the physics teacher wanted me to take part in the competition for high school kids in France. I was trained every Saturday afternoon by him. I passed then this *"concours général"* in mathematics and physics, and in physics I did quite well without being at the very top. Of course, my grades in mathematics suddenly dropped and did so dramatically. If I remember correctly, my first grade was 0.5 out of 20. Some other people would even get 0.25 and 0, and the best grade would perhaps be 8 out of 20. That was a big shock for me!

Still, the physics teacher gave me the feeling that I was able to do science efficiently. A strange balance between somebody who was very supportive, helping me to really learn more about physics and so on, and a totally different personality who managed to capture my attention and my interest in mathematics.

After that, I went to what we call *"classes préparatoires"* in the French system. At the *baccalauréat* my grades in mathematics had been good, although not fantastic. Many of the other pupils there had far better grades in the exam. To my surprise, however, I felt much more comfortable than most of them. The reason is that the jump in level in mathematics between the *lycée* and the *classes préparatoires* is quite significant. Many of the other students struggled a lot, but not me! I already knew how to work by myself, and, to my surprise, I ended up number one or two in mathematics and physics in that class in the first year. The second year was much more difficult because the teacher then was very peculiar. He was certainly a remarkable mathematician. Still, his way of teaching was very strange: he graded people according to what he expected from them, and this in a year when students must pass the entrance competition for the *"grandes écoles"* at the end for which you need to position yourself in comparison with other students. Since I had been successful in the first year, he expected a lot from me, and I ended up disappointing him. As a result, I got bad grades while my neighbour in class, who achieved far less, ended up with better grades than me; very disconcerting! This told me that perhaps I was not good enough to do mathematics.

Portrait of a young mathematician

MR: *How did that change at the university?*

JPB: I entered *École polytechnique* in 1966. At this time, quite a significant part of the teaching consisted in mathematics and physics courses. It came quite unexpectedly to me and many of my fellow students that several of the teachers, in physics for example, were not so competent, if not truly incompetent, as the mechanics teacher was. My analysis teacher was Gustave Choquet, a great mathematician who was also highly motivating and extraordinarily elegant. The poor teaching we were subject to in some disciplines was not acceptable to a group of students, who decided to organise some kind of task force to substitute for the teachers. I was one of the leaders of that group. We took all possible books in mechanics, in French, in German, in English, in Russian, everything we could find, and we tried to build our own view of mechanics. The group I mention consisted of perhaps 12, 15, or 20 people out of the 300 students of the promotion. This is the way I became introduced to research in the first place, not at a very high level, and also to teamwork. Just to replace bad teachers! It may sound crazy, but it had the consequence that many of my fellows from that year at *École polytechnique* decided to become researchers.

During my time at *École polytechnique*, I learned a lot of science seriously, for example quantum physics, some other parts of mathematics, and, beyond this very peculiar work in mechanics, we organised a seminar on general relativity ourselves. Still, when I finished École polytechnique and compared the amount of mathematics I had learned with that my friends at École Normale Supérieure had been exposed to, I told myself that I was not knowledgeable enough to do mathematics professionally. This is why I looked for people in mechanics in Paris to tell them I wanted to study mechanics further. This was after 1968, and I had already a very clear idea of what kind of research problem I wanted to consider, which was solving the Euler equations for fluids in the spirit of Vladimir Arnold. When I told the mechanics professors I met in Paris what I wanted to do, all of them told me: *"No, this is not the way it works. We will tell you what to do"*! And so I went away to the field that was the closest to mechanics, namely differential geometry. Choquet was still my advisor, but of course, that was not his field. Therefore, I moved quickly on and became a student of Marcel Berger.

MR: *But your first degree was in Engineering, is that right?*

JPB: It was a degree from École polytechnique, an Engineering school. There the courses were essentially about fundamental science. During my time there, I also took several courses at the university, leading to a master's in mathematics from the University of Paris, not yet divided into several universities as it is now.

A career in mathematics

MR: *I learned that you got your first position in the CNRS already at age 21.*

JPB: Yes, but that time was very special. The CNRS was expanding very significantly. In that year 1969 alone, the number of people hired in mathematics was 36, if I remember correctly. Most of the people hired were a bit older than me, still very young. I had published one paper on mechanics. It was not really a research paper; at least for a student, it was not so bad to have a paper published. I was given the position very early without having a PhD. Actually, at that time there was no PhD in France but a *"thèse de troisième cycle,"* which today one would rather call a "master thesis." The main diploma was the *"thèse d'État,"* of the level of a habilitation, which I passed much later, in 1974.

With Berger and me being a CNRS fellow, everything became easier: he never tried to tell me what to do, I could do what I wanted. He gave me a fantastic gift: he had just entered the CNRS himself leaving his university position, and, since I was his only student having a CNRS position, he spent every Tuesday telling me everything he knew about geometry, which was great! The next day would be devoted to attending his seminar. There were very active and interesting participants, among them, e.g. Yves Colin de Verdière and Lionel Bérard Bergery. Berger himself was very modest, actually much too modest. He always claimed that he never did anything major, which is of course absolutely not true. For me, another major gift from him was that he put me in direct contact with extraordinary mathematicians such as Eugenio Calabi, Shiing-Shen Chern, Isadore Singer, Michael Atiyah, Jim Simons, and so on. Thanks to the introduction by Berger, I was given special access to these very special people.

I. M. Singer, J. Simons and J-P. Bourguignon, New York, 2012.
(Photo: Friends of IHES)

MR: *You got a network right away.*

JPB: At that time, in France at least, when you were not doing algebraic geometry or number theory, you were not really a mathematician; I was therefore not one. Moreover, most mathematicians were very ignorant of physics. I was one of the very few mathematicians at that time who had a decent understanding of quantum mechanics, for example. It went back to my substantial training at École polytechnique, where I enjoyed a good teacher in that part of physics, and I had studied the subject thoroughly. As a result, I was in a privileged situation when the opportunity arose, with gauge theory, to get closer to physics and to read papers in that field, to understand problems posed by physicists, and to talk to them.

New connections in the US

MR: *And to make connections.*

JPB: Yes. A big opportunity came in June 1972 when Jim Simons invited me to Stony Brook. He had visited Paris and listened to me at the Berger seminar. The next day, probably after having spoken to Berger, he sent me a fax offering me a position to be taken on the 1st of September. Not an easy decision, although I could be on leave from my CNRS position. Still, my family was involved, and my wife too had her job, as a nurse. We already had a little girl. My wife in the end agreed, and we decided to go, a jump into the unknown.

In Stony Brook, there was an incredible concentration of differential geometers, 14 of them alone at that time: besides Simons himself, Shing-Tung Yau, Jeff Cheeger, Detlef Gromoll, Wolfgang Meyer, John Millson, James Ax, John Thorpe, Leonard Charlap, and a few others. It was for sure one of the best places in the world to be for a young differential geometer!

On top of that, Chen-Ning Yang was in the physics department. In early 1973, an attempt was made to organise a seminar on gauge theory between mathematicians and physicists. It stopped after three meetings.

MR: *Why that?*

JPB: Well, the physicists had the feeling that mathematicians were too obsessed about the global point of view with topological consequences, and the mathematicians found the physicists too obsessed about the local gauge invariance. Anyway, I had exchanges there with very good theoretical physicists and, thanks to my initial training, I was one of the few mathematicians who could really talk to them without being lost. By the way, it was exactly at that time that Simons, together with Chern, developed the Chern–Simons theory.

Bourguignon and Calabi in the IHÉS auditorium, 2007.
(Photo: Jean-François Dars)

This visit to the US has been extremely important for me because of the fantastic concentration of differential geometers in Stony Brook. Moreover, it was there that I met Yau. We were both teaching calculus. This helped us become good friends. We worked together and we published a joint paper in which we tried to disprove the Calabi conjecture, which of course turned out to be a wrong attempt!

Then, I spent the summer 1973 at Stanford at the invitation of Robert Osserman. During this visit, I received a call from Chern inviting me to have lunch with him. I was rather amazed that he wanted to talk with me. I had met him briefly before, in Oberwolfach, in 1970 or 1971. He just wanted to know what I was doing. Later, I learned that he did that with several young people.

This meeting changed a bit my psychology because it gave me the feeling that what I was doing was perhaps not so stupid. After all, if Chern wants to hear about it, it may be worth the effort!

At the end of the summer, my wife and I decided to come back to France and not to stay in the US. Thanks to this stay, I got really close to Jim Simons, and, later, this made a huge difference for me in many ways.

The connection to gauge theory developed further. I think the best paper I published was written jointly with Blaine Lawson in the late 1970s. Blaine had been visiting IHÉS (Institut des Hautes Études Scientifiques in Bures-sur Yvette on the outskirts of Paris) for the academic year 1977/78. We talked to each other from time to time. At some point, I had to prepare a course to introduce physicists to the mathematics of gauge theories, and I submitted my draft to Blaine. Physicists had a conjecture about stable Yang–Mills fields on the 4-sphere. At some point, I mentioned to him that I knew how to do half of the proof, and Blaine said: *"Really? I know how to do the other half!"* And so, just talking to each other, within a week, we had the paper! Of course, we could have spoken to each other much earlier in that year, I was struggling with the part I couldn't do, and he was struggling with the part he couldn't do.

The inspiration for the result came from what has probably been the last published paper by Jim Simons, at a conference in Tokyo. He looked at a similar question for dimensions 5 and above. But the interesting dimension for physicists is 4, and then it is more difficult. When Blaine and I published the announcement of our result, we invited Jim to sign the paper with us. He was reluctant as he had not made a real contribution. At that time, Blaine had moved to Stony Brook. It was not so easy to convince Jim, because he had left mathematics a year before. He had inspired us, and therefore we felt having him sign the paper was appropriate. He finally accepted (see [6]). Later, I learned he found it nice that we invited him to cosign the announcement.

After that, I spent the spring of 1980 at the Institute for Advanced Study, for a special semester on global analysis. It was an incredible semester with Yau, Karen Uhlenbeck, Rick Schoen, Peter Li, Robert Bryant, Clifford Taubes and so on. Calabi would come to the institute very regularly, and it was really a fantastic period mathematically, just the moment where global analysis was exploding.

I then spent the fall in Stanford. There, I was supposed to work with Yau, but Yau had just moved to Harvard. Of course, being in Stanford was very nice, Peter Li was there. Although I could have considered staying longer in Stanford, we decided to return to France at the end of 1980.

These stays in the US have been mathematically extremely inspiring. Still, my wife and I, we never felt we could live in the US for good. It may be difficult to explain why. It really has to do with the way society functions. We are truly European.

Mathematical results and methods

MR: *I would like to ask you which of your results and methods you are most fond of? But perhaps you have already answered that question?*

JPB: There is another result [1], again a 4-dimensional one, which I like a lot: *"on a compact manifold with non-vanishing signature, a Riemannian metric with harmonic curvature, as a vector-valued two-form, is necessarily Einstein."* It is a nice combination of an analytic assumption and a global topological assumption, and the way these two interact is quite subtle. I got the basic idea during a year I spent in Bonn in 1976/77, but I was stuck for quite some time. Listening to a lecture on a completely different topic, I realised how to attack this missing algebraic lemma, which in fact is just an exercise. My hope then was that it might lead to new developments, although this has not happened so far.

In the meantime, the Calabi conjecture had been proved by Yau. I spent quite a lot of time checking the proofs, thinking, organising seminars and so on together with many people around Berger.

A lot happened then within global analysis, mainly thanks to Yau, Uhlenbeck, Schoen, and others. In 1979 at a conference held at the TU Berlin, I lectured on Einstein metrics and Ricci curvature [2] and proposed as a problem to consider the flow determined by the Ricci curvature in the space of Riemannian metrics. That's a reason why some physicists call the Ricci flow the Ricci-Bourguignon flow. At that time, I could not prove that the Ricci flow exists. Local existence was proved later by Richard Hamilton and Dennis DeTurck.

The end of the seventies has been an exceptional concentration of new ideas, new problems, an entirely new dynamics of the field of global analysis, and even a new name. I felt really in the middle of this because of the connections I had established.

Science administration

MR: *And you really seized the opportunities! But at the same time, you got involved in science management. How did that occur?*

JPB: I got elected as chair of the Mathematics Committee at CNRS when I was only 33 years old and still in the US. The function started only in 1981. That was not expected and *a priori* not very reasonable, but all the people who should have been elected for the function were not elected for various reasons. The choice fell on me. That resulted in an extraordinary opportunity to look much more broadly into mathematics and how to interact with scientists from other fields. My job as chair was to defend mathematics in front of physics and other subjects. At that time, I was still very young, and therefore, if I wanted to successfully push anything forward, I had to prepare twice as much compared to other more established people.

If I look back, it was certainly the time when I started to have a much broader knowledge of mathematics. I also found out that one actually needs to defend mathematics. This is not always a trivial exercise, partly also because of the attitude of some narrow-minded and sometimes arrogant mathematicians!

I started to get close contacts with scientists from other fields, looking for people who could support or help us. At that time, the chair of the Theoretical Physics Committee for CNRS was Louis Michel, a French physicist who was a permanent professor at IHÉS. He was very tough, and already highly recognised, member of the *Académie des Sciences*, and so on. I had some bitter fights with him. He defended theoretical physics, I defended mathematics.

Some ten years later, Michel was put in charge by the professors at IHÉS to look for a new director. His call to ask me whether I would be willing to consider becoming the director of IHÉS came as a huge surprise to me. I thought that could not work because I remembered our tough exchanges. But it was just the opposite, because he liked the way it had happened. I think this is psychologically interesting in the sense that he accepted that some people could defend other points of view and that he even valued it. Anyway, this opportunity came completely unexpected!

MR: *And the story goes on: You were president of the Société mathématique de France, from 1990 to 1992, of the European Mathematical Society from 1995 to 1998, director of the IHÉS from 1994 to 2013. And to the great satisfaction of the EMS Executive Committee – and of all mathematicians, I believe, you became the president of the European Research Council from 2013 to 2021, with a short interruption. And that happened after ordinary retirement age!*

You are still very active, among other things as member of advisory boards, for example in Germany, in Finland, in Denmark and in Ukraine. We certainly cannot cover all your activities. I am sure you need a special mind-set, a particular gift, in order to be successful as a top scientific administrator and politician?

JPB: After my period as chair of the CNRS Mathematics Committee, I was elected member of the Scientific Council of CNRS. This Council gathered a really interesting group of people, and it gave me new opportunities to interact in a very constructive way with non-mathematicians.

I became professor at École polytechnique in 1986. At that moment, mathematics at the universities in France was in big trouble: All vacant positions in mathematics were taken away to create departments of computer science. It was obviously important to establish departments for this emerging science. The idea that all positions for that purpose should be taken from mathematicians was stupid, but mathematicians did not know how to avoid that. For example, in the 1980s the mathematics department in Strasbourg could not hire anybody for about ten years, which is a killer.

MR: *You miss a whole generation!*

JPB: Yes. At that time, the president of the Board of Trustees at École polytechnique was a banker, Bernard Ésambert. After being elected as professor, I paid him a visit, telling him *"I think we need your help. French mathematics is in trouble, and we must get people outside the community to make the point."* He said: *"I'm willing to do that and help you find people in business who can make the case. But you will have to accept that the meeting to make the case should not be addressed to mathematicians alone, but much more broadly."* He helped me, together with a few other people, among them Jean-Francois Méla, the then president of the *Société mathématique de France*, to create an event which we called *"Maths à venir,"* which in French can mean "to come," but also if

you join the last two words – "future." The meeting took place in November 1987, shortly before the reelection in 1988 of François Mitterrand as president of the French Republic. The event was an extraordinary success. We could convince famous mathematicians of the previous generation, like Jacques Dixmier and Henri Cartan, to be involved. The coverage in the press was fantastic, thanks to Méla who knew well the right people to connect to. Alain Connes gave an extraordinary lecture with non-mathematicians in mind. The advisor of the French president attended that lecture. I was in charge of taking care of him. When he left after listening to Connes, he said: *"we must help you, we cannot leave it like this."*

Then Mitterrand was reelected, *a priori* a piece of good news for us. Consequently, it was decided that a special directorship for mathematics would be created in the Ministry. Before that, mathematics had always been under physics. Moreover, all positions taken away from mathematicians to create the computer science departments were given back. Of course, not immediately, but over a range of 10 years.

In 1990, I became president of the *Société mathématique de France* a little bit by default, because nobody wanted to take the job, until it finally fell on me, and I accepted it. Not so clear, because at the time, I was in Zurich visiting the ETH for three months. There, I could talk to many people, and among them with Jürgen Moser, an exceptionally bright and deep mathematician.

The European Mathematical Society and the IHÉS

MR: *Did it not get complicated when the EMS was to be established?*

JPB: Certainly. The EMS was created in 1990 at a meeting in Madralin, close to Warsaw, at a difficult moment, shortly after the fall of the Berlin Wall in 1989. There was tension between the British and the French views. The Brits wanted the EMS to be a society of societies, whereas the French wanted mathematicians to be able to join the society individually. Discussions in Madralin were tough. And it took all the diplomacy of Hirzebruch, who had already been chosen to be the first president, to bring the two approaches to converge. When a compromise had been found, Michael Atiyah was then offered to become the member number 1 of the society! It was very nice on his part to accept that because the compromise was the opposite of what he said should be done!

MR: *The ice was finally broken! How long did the meeting last?*

JPB: It lasted two days, but the first day was quite violent! Even to the point that some colleagues from the UK said that if the French don't want to join the EMS as we propose it, maybe we set up the EMS without the French. But the Belgian and the Italian representatives and a few others had the same vision as us. It ended fortunately with a compromise, members could be societies and individuals. Because of this big tension back in 1990, I was very surprised when, in 1993, Hirzebruch called me, close to the end of his mandate, to ask whether I, one of the key troublemakers in Madralin, would agree on being his successor.

MR: *This sounds like the same story as the one with Michel and the directorship at IHÉS that you told me before!*

JPB: In a sense yes, but my personal relation to Hirzebruch had always been very good, although we never really worked together. He was such an amazing administrator and mathematician, of course, but also able to get things done in a very gentle way. For me, he has been a model in terms of management.

I started my mandate as EMS president in January 1995. At that time, I had already taken up the IHÉS directorship. I took this job one year later than planned because I had agreed to spend six months at MSRI in Berkeley in the spring of 1994, and I didn't want to give this up. I knew that being in charge of IHÉS would leave me less time to do mathematics! It was not very nice to Berger, who held the director position, because it meant he had to stay one more year against his intention.

These six months at MSRI were very interesting, as well. William Thurston was the director there, and the MSRI was going through some difficult times. For me, it was also a good opportunity to observe how such an institute functions. I went also to the theoretical physics Institute in Santa Barbara, now known as the Kavli Institute. That was also a great occasion to talk to people, find how they organised an institute and events.

This time was a learning period for me. But, when I started, I had not properly estimated how bad the financial situation at IHÉS was. Up to the point, that soon after having been hired in 1994, I had to fire myself because there was no money to pay me! That was not terrible, because I could just bounce back to my CNRS position. But it shows that the financial situation was really bad.

This convinced me that we had to look for new money urgently; the institute had not really worked on that option, but there was no other way! As a result, we started in earnest to try and find sponsors who would really bring new support to the Institute. Jim Simons had at that time not only switched from mathematics to business, but he had already become quite rich. He made his first gift to IHÉS on the occasion of his 60th birthday. At the end of the reception at his home next to Stony Brook, he told me, *"I think I never gave money to the IHÉS. Would $250,000 be good for you?"* I said, *"Of course!"* The first time we got money from Jim was just a gift at his initiative, I didn't even ask for it. He proposed it.

Later, at the conference for my own 60th birthday in 2007, at the beginning of his lecture he said: *"I made a mistake. At some point, I gave money to Jean-Pierre. Then he learned how to ask me for money!"* He and his wife Marilyn have been fantastic supporters

of the institute. Without Jim's and Marilyn's support and advice, IHÉS could not have done what we managed to do; and their support continues to this day!

MR: *Generally speaking, you must have learned a lot on how to create trust in the first place, and then also to lobby for mathematics, for money but also for influence.*

JPB: In some sense, yes.

Pure and applied mathematics under one umbrella

MR: *What about the relations between pure and applied mathematics?*

JPB: Thinking back, the period from the mid-eighties to the end of last century was characterised by a very significant move forward towards applied mathematics and, at the same time, a broadened interest of other scientists for mathematics. I knew that first-hand concerning physics. But there was also biology moving forward, the importance of statistics grew very significantly. Rather than considering that applied mathematicians took away positions from fundamental mathematicians, it became necessary for mathematicians to cooperate as a global family. Already with *"Maths à venir"* and then as president of the *Société mathématique de France*, I had to make sure that the pure and the applied mathematicians could work together. We learned quite early that, without a common defence of our subject, we would not have a chance. I think, in France we were reasonably successful in this respect; in some other countries it took longer to arrive at that conclusion. For example, the opposition between pure and applied continued for quite some time in Germany. This is one reason why the creation of the new Max Planck Institute in Leipzig was important: its name is "Mathematics in the Sciences," the sign of a much more open approach. And there, the personality of Jürgen Jost, among others, fits perfectly with this vision because of the breadth of his work. He could reach out to many other fields, in particular biology, and even the humanities. This period has been very important for a broader approach by mathematicians, even if some still resent that. But I think this change was essential and justified.

MR: *If you look back, what were the most interesting issues? What were the obstacles? What do you consider as your successes as EMS president?*[1]

JPB: Well, Hirzebruch had already prepared the creation of JEMS, the Journal of the European Mathematical Society, even if it was finally put in place during my time. I convinced Jürgen Jost to become the first editor-in-chief, which I think was a good move. That was a collective decision, of course. It became very important for the identity of the EMS that it would have a journal that was considered by mathematicians as a reference journal, and I think this has been achieved!

Four EMS presidents: V. Mehrmann (2019–22), J-P. Bourguignon (!995–99), M. Sanz-Solé (2011–14), P. Exner (2015–18) at the EMS 30 years celebration at the International Centre for Mathematical Sciences in Edinburgh

There were again some difficulties, because some people wanted to have it altogether focused on pure mathematics. I did not think this was the right idea, and we tried to allow a broader content.

At that time, a very substantial split between the pure and applied communities still existed in some countries. As EMS president, I had to understand the variety of situations and see how one could work on it and make people finally comfortable with the change of situation. Moreover, you must find people who have an attitude which is fundamentally respectful, open to discussion and not just defending their *pré-carré*, their (sometimes very small) comfort zone, an attitude which is for sure counter-productive.

This is also why it was important to make sure very soon there would be an applied mathematician as EMS president, and this is what happened. After a lot of discussion, because some people disagreed!

MR: *Rolf Jeltsch, a numerical analyst from ETH Zurich, became your successor!*

JPB: And Rolf's presidency has been a very successful one.

[1] More about the history of the EMS in [5].

Institut des Hautes Études Scientifiques (IHÉS)

MR: *Is the problem over?*

JPB: The danger of a clash between pure and applied is, I think, definitely over. I learned that already at the IHÉS, which was constructed as an institute bringing together theoretical physics and mathematics. The mathematics part was very pure; Alexander Grothendieck and René Thom were very pure mathematicians. Nicolaas Kuiper quickly appointed for example Jean Bourgain, who was fundamentally a problem solver, somebody with a quite different attitude. When Bourgain was hired, he worked mainly on Banach space theory, but Kuiper anticipated very quickly his fantastic capacity to contribute to harmonic analysis, using very subtle estimates, and using them also in several fields including number theory. In that way, the image of the institute was broadened by the kind of mathematics Bourgain was contributing to. During my directorship, Misha Gromov started to work on mathematical aspects of biology, and I tried to support him in that move. We did not hire a biologist as permanent professor, but the IHÉS organised several very significant conferences, bringing together mathematicians and biologists.

We also got closer to engineering. I am very glad that the visiting chair, which was created with the support of the Schlumberger company, allowed us to invite prominent scientists working at the interface of, e.g., mathematics and computer science, or mathematics and statistics. For example, Stéphane Mallat, who is now professor of data science at Collège de France, held this chair for one year. During his time at the IHÉS, he discussed, e.g., with Gromov; not exactly what you could have expected! Mallat had done great mathematics in wavelet theory before, and he even founded a company. But when his students wanted to celebrate his 60th birthday last year, they organised an extraordinary conference at IHÉS. Among the attendants, we had all the leaders in artificial intelligence worldwide.

These are some examples of the way I tried, during my time as director, to open the Institute and to show that there were other ways of doing mathematics which were important to stimulate new mathematics, of course discussing with the permanent professors and the members of the IHÉS Scientific Council.

Today, it is completely obvious that artificial intelligence (AI) will bring important developments. But Stéphane Mallat keeps saying that a difficulty with these very efficient algorithms is that we don't yet know *why* they are so efficient. From a mathematical point of view, it is not acceptable not to understand why this is so! That shows that there are still some pieces of mathematics missing that need to be developed and understood. Perhaps, new concepts or new approaches to analyse neural networks, the tool on which AI is built. We still don't have a theory of neural networks sophisticated enough to explain why they are so efficient.

MR: *A better understanding would give us a way to improve the applicability…*

JPB: Yes, but also to diminish the risk that you are fooled by what you see. The networks are efficient, perhaps for bad reasons. Unless you have understood something in depth, you cannot find the situation satisfactory.

MR: *It might be some sort of voodoo in the end…*

JPB: Coming back to IHÉS, we had to improve the facilities, which meant finding money for that, and thus stabilising the institution. Equally important for such an institute is to be able to attract the right people, the absolute best scientists that you can find and that are young enough, because the institute does not pay so high salaries. When they are very young, your offer may be attractive.

MR: *How would you do that, finding out who is really promising?*

JPB: There is quite some betting over it! You try and see and visit places where young people speak, and find out whether you are impressed or less so. You listen to people, and you ask other people for advice. I must say some fantastic mathematicians helped me a lot with that, Jacques Tits was one of them, I talked with him very openly, exploring who could be the next Grothendieck. André Haefliger was also very helpful. Their help was very much appreciated because they did not act as lobbyists. They did not defend their special area. They were just listening and observing. I owe them a lot! I also got help from some physicists from France and elsewhere. There was no reward for them, except perhaps the feeling that they could help the Institute continue to develop itself, and to promote the right people. Finding the right people at the top is a bet, and you can make mistakes. If you don't take risks, you have no chance of succeeding!

The European Research Council (ERC)

MR: *When you were about to finish the directorship of the IHÉS, you went on to become the president of the European Research Council. Again, an administrative job at the very top, but this time not promoting mathematics in the first place. You had to represent the entire spectrum of European science, including natural sciences, medicine, humanities, social sciences and so on. Mathematics is just a minor player in that game; there are not that many mathematicians compared to, say, biologists, or people in the medical sciences. That must have required something very special from your side, it must have been tough. Can you expand, please? Perhaps you can also give advice to mathematicians who want to apply to the ERC?*

JPB: Perhaps you don't know that after my time as president of the European Mathematical Society, I've been involved with a group of people who felt that scientists at the European level were not properly organised as a lobby. With the biologists in the lead, I was soon involved in the creation of the organisation called "Initiative for Science in Europe" (ISE). There, we dreamt of something like the ERC, but we did not know how to make it happen. ISE became for sure the main lobby for the creation of the ERC.

And then I was also directly involved in the creation of the association EuroScience in Strasbourg. It was in fact an outgrowth from a small committee set up by CNRS to develop its relations with Europe altogether. And there I met many people who later became very crucial at the ERC level. For example, I met for the first time Helga Nowotny, who then became the second president of the ERC Scientific Council. My involvement with scientists in Europe from other disciplines dates back to the late 1990s and the early years of this century. Moreover, I was a member of the Scientific Committee of several EuroScience Open Fora (ESOF) until I became the ERC president. I withdrew to avoid any conflict of interest.

I had been involved with all these people from different countries, different disciplines, different approaches for quite some time, and it was another component of my life as a scientist to talk to these people. I developed an interesting network with the common aim of helping to promote science at the European level.

I also came in touch with another person who played a very important role in European science, José Mariano Gago, by a random coincidence. Gago was a physicist who was the Minister of Science in Portugal several times. He decided that Portuguese science had to be evaluated internationally. He looked for people who would be willing to participate in such evaluations, discipline by discipline. I became a member of a committee in charge of evaluating Portuguese mathematics several times. The chair of that committee was Irene Fonseca, a Portuguese mathematician working in the US – she is currently vice-president of the AMS. During this time, while being the director of IHÉS, I became a friend of Mariano Gago, and he would call me asking for advice. He then became the key actor for the creation of the ERC, jointly with Philippe Busquin, a former Belgian Minister of Education, who became the European Commissioner for Research, Science and Innovation at the turn of the century and who really fought for the creation of the ERC. Reaching that stage was quite difficult since several of the big countries were not in favour. Germany was against it, France was neutral. It was the smaller countries: Denmark, Sweden, the Netherlands, Ireland, Austria, that felt that a European Research Council could make a positive difference for them, and for Europe as a whole. The key meeting took place in Dublin in 2005, under the Irish presidency. It was the last-minute change of mind of a Minister of a large country that made the creation of the ERC possible. I then became the first chair of the ERC panel for starting grants in mathematics, and that was

European Research Council

Established by the European Commission

a wonderful experience. The panel members really wanted to hear about mathematics!

Some people seem to believe that I prepared my presidency during this time, but not at all! Of course, I monitored how the ERC evolved. Still, I could not know how its further development could involve me at some stage. Actually, the EMS played a very important role in my decision to accept to be nominated for the president post. The only way to become a candidate was to be nominated by institutions. Marta Sanz-Solé, the EMS president at that time, called me and asked me to submit my CV as a sign of my interest to be a candidate. I answered: *"Marta, I have already plans for my next year, from 2013 until the fall of 2014. And sorry, unless you find other people who want to nominate me, I will not submit my CV."* Then a few days before the closure, other supporters had been found, among them, EuroScience and the CNRS.

Finally, I had to consider seriously whether I was interested in being considered for this job. Indeed, in September 2013, I finished being the IHÉS Director, having reached the retirement age for CNRS. I wanted to leave a free space to act for my successor Emmanuel Ullmo. For that purpose, my wife and I had planned to spend the entire 2013/14 academic year travelling around the world, spending three months in four different places. We wanted to start in Stanford, and then to travel to New York, Hong Kong, and Beijing. And, each time, we would be accompanied by one of our grandchildren. We had four at that time. Since the probability that I be chosen was quite limited, I decided to send my CV in March 2013. The selection process then developed. I was first selected by the search committee to be interviewed, then among the three finalists to be interviewed by the ERC Scientific Council, and the Commissioner on 4 July. Suddenly, all our plans with the grandchildren were collapsing! We were only able to take two grandchildren with us for the first three months in Stanford. They went to an American school, and it was a wonderful experience for us as grandparents, and, I believe, also for them. The other two grandchildren are still frustrated that they couldn't travel with us.

MR: *Understandable! I still remember the great applause in the Executive Committee of the EMS when we were informed that you were, in fact, chosen as president.*

JPB: It was a surprise to me. I only wanted to be at least interviewed by the selection committee. Otherwise, it could have meant that the people who supported me had made a wrong choice. I was quite surprised to learn that I was proposed for the position. The French Minister called me and told me I was one of the three finalists! She had just been informed by the Commissioner. I happened to be in New York at the time. And I realised that I may have to change my plans.

These years at the ERC have been fantastic: The contact with high level scientists of all kinds, and the staff at ERC was extraordinarily gratifying.

MR: *Did you have to move to Brussels?*

JPB: Oh yes, I had to. It was part of the duty. I was very lucky because Commissioner Carlos Moedas with whom I had to interact was remarkably trustworthy. We had a very direct, simple relation. We did not agree all the time, but that was not the point. He would listen to me and respect me, and I would respect him also. He is an intellectually brilliant man, now the mayor of Lisbon. I was very lucky. The Scientific Council, too, was composed of very good people.

The bad news was that my successor failed, and he was then asked by the ERC Scientific Council to leave after only three chaotic months. It still puzzles me that it could not be spotted from the outset that nominating this person was risky!

MR: *And you had to carry on for another year!*

JPB: That is what happened, not expected either! My wife was not very happy, I can tell you. It happened during the pandemic, and I stayed home, spending almost all my time in front of my computer. The pressure was considerable in the fall of 2020 because of the financial negotiations for Horizon Europe that were taking place with the European Parliament (EP) and with the Commission. I used the network I had built there over time. I could quickly connect to people despite the pandemic. The original budget of Horizon Europe was very disappointing; the EP managed to increase it a bit, still not as much as we would have liked.

The support given by the ERC staff has been wonderful. I have been in contact with many agencies in the world during my professional life. I must say that the ERC staff are of a very special kind, highly professional and committed. They know how to work together. I enjoyed this environment a lot.

It was more difficult to cooperate with some people on the Commission side. Staff there is on average also of high quality. Still, they are often afraid of making a mistake. They tend to be very conservative and want always to make sure that nobody can have serious objections to anything they propose. This is of course not the right atmosphere. Also, I must say that many refuse to accept the idea that science and research function in a certain way that does not necessarily follow the general rules, and that was often frustrating!

MR: *They are absorbed by legal questions, right?*

JPB: Yes, they want to protect themselves. The idea that the ERC is under the responsibility of the Scientific Council is unbearable to some of these people.

MR: *Do you think mathematicians exploit the ERC well enough by now?*

JPB: Not really. There are not enough mathematicians applying. Many mathematicians have not understood that the ERC was built for the scientific communities. The panel that judges your application consists of experts from your field. Many mathematicians think that the ERC grants are too large. This is not the rule of the game. People should ask for the right amount of money for what they want to do. The people who are going to judge your application are your colleagues; they know what is relevant for your project. When you ask for too much money, it's not going to be a good point for you. I know that institutions sometimes press people to apply for more money because they get their share. You should resist, you should make a proposal which is adequate for your project.

When ERC started in 2007, the amount of money going to mathematics was almost equal to the amount going to computer science. Now the ratio is 1 to 2. And the growth of the two communities has not been 1 to 2. Mathematicians are not taking enough advantage of the ERC. The amount of money given to an ERC grant for a mathematician is typically about half the maximum amount. The amount is probably relevant! Some projects need more money, others don't need that much. For many institutions, just having an ERC grant makes a difference in terms of visibility and respectability. Much more than the amount of money! I kept repeating this, but I don't think I've been successful in delivering the message; perhaps I didn't say it in the right way.

MR: *Well, then it is good to have it repeated here.*

Ukraine

MR: *Can we move on to a different subject? The European continent is right now shaken, to put it mildly, by the war in Ukraine. Historically and in the near past as well, Russian mathematicians*

and Russian mathematics have been very important and influential. Ukrainian mathematicians urged the EMS to suspend all relations with Russian mathematics. The EMS suspended only membership of the Russian mathematical societies which are under direct state influence and financing. Was that the right decision, in your opinion?

JPB: Very complicated! There have been statements by rectors of some Russian universities supporting the invasion, and this is totally unacceptable to me. Still, it is extremely important that scientists, on a personal basis, continue to keep contact with their colleagues. The learned societies are, in a sense, in between. Depending on the way they are set up and operate, it may vary very much from one country to the next how they are related to political power. One must check very carefully, on an individual basis, whether a learned society is in fact independent or not.

MR: *You are also personally engaged helping Ukrainian mathematicians.*

JPB: I must say that the way Ukraine defends itself is extraordinary. Nobody would have thought they would be able to do that when Russian troops started the invasion! The price they pay is so high. The war is still ongoing, it costs many lives, and that is terrible. At some point, the war will end. Ukrainian scientists considered what will happen then. Reconstruction might be slow and complicated; the damages will probably continue to affect the daily life of many. The support of science might not be the priority. To create better conditions for Ukrainian mathematicians, they developed the idea to create a place, an institute, allowing communication of mathematics at the highest possible level within the country. This is how the idea of ICMU, the International Center for Mathematics in Ukraine, came. This institute should give young people, in particular, the possibility of continuing to do high level mathematics in the country. It is to the mathematicians in Ukraine to determine how the institute will function. My role is to help them find money to establish the institute.

MR: *You are on the Supervisory board.*

JPB: Yes, I am chairing the Supervisory board, which, under Ukrainian law, is the equivalent of a Board of Trustees. So far, we have not been as successful as I hoped finding resources. So, I am a bit disappointed. The French government responded to my expectation, granting €200,000 to ICMU, which was the amount we requested. Recently, the Klaus Tschira Foundation committed €100,000 and possibly more through matching. Presently, we continue looking for help from some other governments and from some foundations.

Jørgen Ellegaard Andersen from Denmark is helping me in this endeavour in his country, similarly other mathematicians do the same in other countries in Europe. The key actors are of course Ukrainian mathematicians. Masha Vlasenko at the Polish Academy of Sciences in Warsaw and Maryna Viazovska at École Polytechnique Fédérale de Lausanne are particularly active and engaged; we talk to each other regularly. Compared to their and that of their colleagues, my contribution is very small. I have some experience looking for money, and I would have hoped to be much more efficient than I have been so far.

The fight is not over! I think their view is correct, they must be able to show to young people, that, even if you stay in Ukraine, there is a possibility to be properly connected to high level mathematics worldwide.

MR: *What is the long-term vision for ICMU? Will it be a centre where people come to visit for a certain period of time?*

JPB: The model they chose, which I think is correct, is that of the Isaac Newton Institute in the UK, or the Centre Émile Borel in France, or the Simons Laufer Mathematical Sciences Institute (former MSRI) in Berkeley in the US. ICMU will organise periods, from three to six months, on a topic that visitors and the local people concentrate on. That is what the Ukrainians want to achieve.

And they still need a place which is suitable for this purpose. To organise events, they will obtain support from various societies and foundations. For example, the London Mathematical Society just agreed to support some events. I am confident that they will be able to secure some money for each event in the future.

Mathematics throughout the world

MR: *In our lifetime, mathematics and mathematicians from so-called 3rd world countries have become far more important. China, India, and Brazil are awe-inspiring examples. And that development is certainly to continue, right?*

JPB: We must be very careful with the expression 3rd world. I think that China is not a secondary player at all in many scientific domains; in mathematics, China is even a leading player now, actually very important for mathematics worldwide. That has to do with the country's size, with its long-term investments, with the commitment and the quality of its scientists.

India is a bit different. It has also a very long tradition and, of course, there are lots of things happening in Indian science. The country is also moving forward, but not uniformly. Brazil is also mathematically a very important country, even if, in recent years, the situation has been difficult for many reasons.

Another continent that I've been involved with for quite some time is Africa, where the situation is complex: some countries made very significant progress, and some others face very difficult political and economic situations, with the effect that many

scientists, particularly mathematicians, moved away because it was not possible any more to live there safely.

I chair the Scientific Council of an institute in Benin, the *Institut de Mathématiques et de Sciences Physiques* (IMSP) in Porto-Novo. Actually, its founder, Jean-Pierre Ezin, has been my first PhD student and was the first Beninese to get a PhD in mathematics. Later, he became for some years the African commissioner in charge of Research and Higher Education. The IMSP runs a very significant excellence programme financed by the World Bank. A lot of students come there from many other African countries. They have made fantastic progress in terms of the quality of the training. Still, some practical things can turn out to be difficult. For example, they have a hard time spending the money they have because of extremely restrictive administrative rules that need to be followed to prevent corruption. Unfortunately, this programme comes soon to an end, and it is not clear whether it can be continued in some way, although it has achieved remarkable results in the training of high-level African scientists.

The Role of education

MR: *You have often stressed the importance of quality education, from pre-school to tertiary education, in mathematics and other subjects. In your view, what are the best strategies to provide and improve numeracy and curiosity towards mathematics among young people?*

JPB: This is a very critical issue. And unfortunately, in recent years in the Western world, we rather observe a regression, and especially in France. This is related in particular to the difficulty to attract good teachers, certainly for mathematics. There are now so many companies who want to hire people with a high level of competence in mathematics and who offer far better salaries than those offered to teachers. Salaries of teachers depend a lot on the country. I recently checked that Canadian teachers were quite well paid on average: a beginning salary of a secondary school teacher in Canada is 44% higher than in France, and the end salary is even much higher! So it is no wonder that one has difficulty finding good teachers. Moreover, the job has become more difficult than it was in the past. That's what my sister, who retired after having been a maths teacher for all her career, tells me: her last years were quite difficult.

We must recognise that for kids access to information outside school has grown a lot. If you want to know about something, you just take your phone, and you get the information. Still, if you want to receive it in a proper way, you need to be trained to check that the information is valid. At least in France, school is not designed to teach you that. We probably need to rethink in depth how a school can be organised and what the optimal role of teachers in this context is, because the situation has changed radically.

In France, 80% of the primary school teachers have no scientific training whatsoever. Of course, the Ministry trains them to teach basic science, in particular basic mathematics. Now, if the teacher gives the kids the feeling that what they are being taught in science or mathematics is difficult, the kids will consider it to be difficult, even if it's quite trivial. Not only the content is important, but also what kind of feeling, what kind of enthusiasm you convey, what kind of approach you take. We all know that what made the difference to almost of us are teachers who really gave us the feeling that what they were telling us was important.

The main difference between Asian countries and Western countries at this time is the importance that parents attribute to the training in science. It makes a big difference for the kids if they know that their parents care. They don't behave the same way if they have the feeling that no matter how they behave, the parents will support them.

I think dealing properly with the education issue is extremely important. Things are changing quickly. Just imagine the possible impact of ChatGPT on school evaluation. How can you give homework exercises when these tools are available? How can you be sure that the kids have done the work themselves? We must rethink the situation collectively; it is not just mathematics. One certainly must put a lot of thinking into that; however, I do not see it happen, at least in France! This is very important! The countries which really progressed spectacularly worldwide in recent years are those which have put education as a top priority for many years. South Korea is an excellent example.

Outreach

MR: *Outreach activities are important for the mathematical community; you have contributed yourself substantially. Can you mention some examples, offer some advice, please?*

JPB: This is connected to my own interest in Art, although I am not an artist. On some occasions, I had the opportunity, often by coincidence, to be in contact with people in the world of Art. Here is an example: The world-famous Japanese photographer Hiroshi Sugimoto made an exhibit at the *Fondation Cartier pour l'Art Contemporain* in Paris showing a collection of photographs of mathematical shapes from the University of Tokyo. These were huge pictures. For a reason still not clear to me, the Foundation called me saying that Sugimoto had been told that I would be the right person to help write the catalogue. I did not know him then. The catalogue was designed in the following way: on the right page, you have a picture he made of a certain surface, and on the left page, he wanted to have an equation for the surface, and explain why it is interesting mathematically. I wrote that part. That was my first contact with him; later, we became friends. I visited his ateliers in New York and in Tokyo. His compan-

ion has a wonderful gallery in Ginza. This connection came really out of the blue!

Before I had visited the *Fondation Cartier* a few times privately, but this association made me become a friend of the director, Hervé Chandès. At some point, he called me to say that he wanted to stage an exhibit on mathematics. That was the starting point for the exhibit whose English title is *"Mathematics, a Beautiful Elsewhere"* – in French it was called *"Mathématiques, un dépaysement soudain,"* a title borrowed from Grothendieck, by the way. This exhibit was not about mathematics *per se,* but rather about the reciprocal fascination that can arise between artists and mathematicians. I helped identify some mathematicians who could contribute. It was an extraordinary experience because the artists were leading ones, and the mathematicians were also prominent figures.

Some people disliked the exhibition, saying that it was telling nothing about mathematics. This was just not its purpose! The exhibition had 80,000 visitors, in line with the usual number of people visiting exhibits at the *Fondation Cartier*. It had also some follow-up events outside Paris: for example, the *Fondation Cartier* showed an overview of several of its exhibits, among them this one, in Shanghai. I just happened to be passing by, and there I could watch again a movie by another famous photographer, Raymond Depardon, which is part of the exhibit, featuring Sir Michael Atiyah, Mikhael Gromov, Don Zagier, Nicole El Karoui and myself!

This has been an extraordinary experience which I enjoyed a lot. Gromov contributed very significantly; in another follow-up, he participated in a radio show on one of his books explaining what he considers key important mysteries in science, in relation with what he showed at the exhibit. This book has been very successful in France; in English it is entitled *"Great Circle of Mysteries: Mathematics, the World, the Mind."* All this was not planned at all, it just developed, taking advantage of the right actors around.

Another such instance came around with the documentary movie "*How I came to hate math"* by Olivier Peyon, mixing French and English. My contribution was to take Olivier to various places where mathematicians gather: the ICM in Hyderabad, MSRI, Oberwolfach, IHÉS, and so on, to give him the opportunity to meet mathematicians and to get a view on how mathematicians communicate. The movie also contains a long interview with Jim Simons, who just passed away and to whom I owe so much. Getting money to shoot this documentary was very difficult. But in the end, perhaps the producers who made the movie earned some money. For sure, that experience was totally unexpected! Jointly with the film director, Olivier Peyon, I have participated in the promotion of the movie in several places in France and Belgium. Each time, it gave rise to an interesting exchange with people in the room, very often parents of school children.

MR: *What about the EMS Diderot Fora?*

JPB: The fundamental idea behind Diderot Fora going back to the time I was the EMS president was twofold: to establish a format adapted to Europe different from big conferences, and to show important connections between mathematics and other human activities. These events were held in three different European cities and, in each of them, a small meeting would be organised. The three places could exchange and communicate with each other by video conferencing; a few years ago, this was of course more difficult than it has become now! Some of these Fora have been very successful, others less so. Mireille Chaleyat-Maurel has been instrumental in getting the Diderot Fora develop. Among the very successful ones, we had one on *"Mathematics and Music"* organised in Vienna, Paris, and Lisbon. In Paris, it happened at IRCAM, the institute of Pierre Boulez, and it led finally to the creation of a mathematical team at IRCAM combining mathematics and music in some unusual ways. The key person, Moreno Andreatta, is now a CNRS fellow and has moved to Strasbourg. There is still a group of researchers at IRCAM on this theme as a direct consequence of the Diderot Forum; a far bigger and longer impact than could have been anticipated.

After a rather long break, Diderot Fora have been recently revived: one was organised on *"Mathematics and Architecture"* in Helsinki, Porto and Prague, and was very interesting. The format is again very relevant now with the travel restrictions.

Let me talk about another outreach effort, which I like very much: during my time at ERC, I insisted that we should communicate about the programme in non-conventional ways. It was not easy to convince people to do that. We opened a call inviting submissions of proposals on how to talk about research projects differently. One proposal that came in suggested using web-based comics or cartoons. And that has worked fantastically well! I can say that with conviction, because several artists who designed a web cartoon continued to cooperate with ERC scientists after the web-comic was finished. Both sides appreciated that it brought them something different. Some of these cartoons have been printed and participated in one of the key festivals for cartoons, in Angoulême in France. When I left the ERC, I got prints as a present. I know that the teams of designers behind these cartoons found it was a very inspiring experience.

MR: *You are not only good at seizing opportunities when they arise out of the blue, but also at opening new opportunities!*

JPB: Well, this approach could have failed just as well, you never know! People in the ERC communication team were afraid that we would appear foolish, that the image projected would result in people not considering these projects as serious. Some of the cartoons were very creative, they allow you to approach research in a quite different way. I really enjoyed doing these things, in collaboration with very special people. We mathematicians tend not to be open and daring enough, we are too afraid of failing. You must take outreach literally!

Family is important

MR: *I would like to come to an end with the same question that Christian Skau and I often had as the last one to the Abel Prize laureates. Forgetting about mathematics for a moment, would you please describe your main private interests, what is at your heart?*

JPB: My wife and I have three children and six grandchildren. We talk to our grandchildren quite a bit, and that has been and is very important for our life. My wife has been fantastically patient because I tend not to know what vacation means. It is important for the family that you sometimes stop being a professional, but I am very bad at that! Right now, my wife complains, rightly, that I am doing too many different things. When I was supposed to retire, I then became the ERC president, and this was one of the most intense periods of my life. She was with me in Brussels at the beginning. After some time, she realised that I was travelling so much that it didn't make sense for her to be alone in Brussels. The family, the grandchildren were then in Paris, and she decided to return to Paris. My years at ERC were actually six tough years, particularly at a moment in life where time starts to move forward faster than earlier.

Our parents have also been very important to us. We were very close to them. After my mother died, my father lived alone, and I would travel almost every weekend from Paris to Lyon to see him and relieve the pressure on my sister, who was living next door. That was quite easy, I was still at IHÉS and could use fast train connections. My parents have been very inspiring for me, and therefore accompanying them in the last part of their life was very important for me.

The grandchildren, too! One of our sons now lives in Berlin, and we go to Berlin every three or four months for at least a week. My grandson wants me to take him to school. He speaks French with his father, Turkish with his mother, who is Turkish, German because he goes to school, and he understands some English, because the parents speak English to each other. He is only seven years old; I find this amazing! Exchanging with my grandson in French or German is very enjoyable. Unfortunately, I do not speak Turkish, which is a great language.

Travelling

What I found wonderful about our profession is the number of friends we could make across the world. Friends with whom we exchange on a regular basis and whom we know very personally. I consider this a fantastic privilege. During my professional life, I had the opportunity to visit Asia many times, and I appreciate that very much. Professor Chern invited me many times in Tianjin at Nankai University where he retired, a great present! Another one is the great interview he gave me in 1990 [3, 4].

My last visit to China in July 2023 was my 43rd visit to China, and my last visit to Japan in April last year was also my 43rd visit.

Bourguignon lecturing at the Chern memorial, 2011.
(Photo: Chern Institute, Nankai University)

My wife also likes visiting these countries very much. We celebrated our 50 years of marriage by taking a one-week leisure trip in China, with the good surprise to discover that, at some stops, some of my former Chinese students managed to get our schedule and welcomed us.

I have also been to Korea quite a bit. Korea is a country that many European countries should learn more from. The Korean society has changed extremely quickly, and the main instrument has been education. For example, Korea was for a long time the country in which the division between men and women was the toughest in the whole world. Now, Korea is the country in the world with the highest proportion of women in tertiary education.

MR: *Interesting, I did not know that.*

JPB: Due to absolute priority given to education for sixty years. Even though the governments during that period were not always that friendly, still they kept an absolute priority on education. This shows how education can change a country, and we should learn from that.

MR: *Some final words?*

JPB: In short: Very often, people believe that you must have a strategy and follow it. Things never happened for me like that. The lesson is: if an opportunity comes to you, seize it! Sometimes, you may take a wrong decision, but opportunities will not come twice. And, as important, you must be open to other people, even to people who are less open-minded in the first place, there might be possibilities for convergence later. Even if you do not expect them, they may just happen, and you must then seize them!

MR: *I am very grateful that you offered two hours of your time, and that you gave us insights into your life and into your priorities in a very open way.*

JPB: You and the EMS are the ones to be thanked for the opportunity!

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Martin Raussen is an emeritus professor at Aalborg University, Denmark. In recent years, his research was focused on applying methods from directed algebraic topology to geometric/combinatorial models from concurrency theory in computer science. He was editor-in-chief of the EMS Newsletter from 2003 to 2008 and a vice-president of the EMS from 2011 to 2016. An interview with him appeared in Issue 131 of the EMS Magazine.

raussen@math.aau.dk