# European Science Challenges and Opportunities

## Pavel Exner

*Doppler Institute*
*for Mathematical Physics and Applied Mathematics*
*Prague*

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# Do we need science?

It is a provocative question, of course, but the answer is simple.

Looking at history, one finds that that there is a strong correlation between scientific progress and wellbeing of the society.

Examples are abundant. One of the best is to look at the the factors which gave Europe the leading role in the world for many decades in the 19th and 20th centuries. A dominant role among them is played by the steady science development started in the Enlightenment period.

Of course, other parts of the world made their weighty contributions. In the present competitive worlds, Europe is trying not to lag behind.

The aim of this talk is to tell you about some recent activities in European science.

# What I am going to talk about

The subject is rather extensive and I have to make a choice. I intend to address in this talk two particular topics:

- Mathematics in Europe seen from a particular perspective: since I have the honor of leading the European Mathematical Society, I will tell you what it is doing

- Then I will switch to a more general topic, namely to funding opportunities in Europe. Eight years ago a new system of supporting excellent science through the European Research Council was introduced and I am going describe how it works and why it can be of interest to Japanese scientists

# Europe – cradle of mathematics

While mathematical ideas and techniques were developed at all continents and the first historical records come from different places and there were periods when other had borne the flag, it is not a false modesty to say that the main body of the science we call mathematics today was formed in Europe.

If this claim needs a proof, it enough to start listing names, for instance, those of Pythagoras, Eucleides, Archimedes, Diophantus, Fibonacci, Descartes, Newton, Leibnitz, Fermat, Pascal, Euler, Laplace, Lagrange, Gauss, Abel, Galois, Hamilton, Riemann, Klein, Poincaré, Hilbert, and scores of the others

# Mathematical societies

Academies in which scientists join have a long tradition which can be traced back to the ancient Greece. In Europe they started flourishing again since the Renaissance period.

As the numbers of working mathematicians grew they began to organize societies with a purely or dominantly mathematical focus. Among the early ones, one can mention

- Amsterdam's Koninklijk Wiskundig Genootschap    1778
- Union of Czech Mathematicians and Physicists    1862
- Moscow Mathematical Society    1864
- London Mathematical Society    1865
- then the gate opened and many other followed

During the twentieth century almost all European countries had mathematical societies, and some had two, three, or even more

# Coming together

The growing sense of European identity inspired efforts to create a society representing all European mathematicians. The original impetus came in 1976 from the European Science Foundation and led to establishing, at the ICM in Helsinki in 1978, of the European Mathematical Council lead by Michael Atiyah.



The 'zeroth president' of the EMS

# Pains of child bearing

However, one should not expect fast solutions when mathematicians decide to solve a problem, to say nothing of the fact that the general situation on the European scene was far from simple.

The next meeting at the ICM in Warsaw was delayed from political reasons, it was followed by meeting in Prague (1986) and Oberwolfach (1988) trying to draft the prospective society statutes.

After the big political change the feeling of urgency grew stronger and led finally to the decisive meeting in the Polish town of Mądralin where representatives 28 societies met in October 1990.

The Mądralin meeting, October 27, 1990

# What was agreed in Mądralin

Two different concepts competed. Most participants wanted a federation of national societies, while the French advocated a society with individual membership.

Complicated negotiations led to a compromise by which the European Mathematical Society has a combined architecture having both individual and corporate members, the later being mostly national mathematical societies but also research institutes and other bodies.

In a sense, the EMS is thus a new building made of old bricks

The Mądralin meeting approved the Statues by which the society is governed by the Council elected by all the members, meeting every two years, while the day-to-day work is steered by the Executive Committee.

The meeting also elected Fritz Hirzebruch the first EMS president, he was followed by an array of prominent mathematicians.
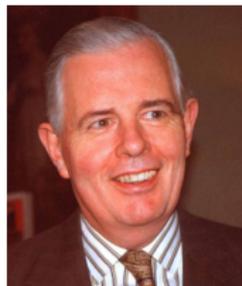
# The EMS Presidents



Friedrich Hirzebruch (1990-1994)

Jean-Pierre Bourguignon (1995-1998)

Rolf Jeltsch (1999-2002)

John Kingman (2003-2006)

Ari Laptev (2007-2010)

Marta Sanz-Sole (2011-2014)

# What we have at the 25th birthday

In a brief summary, the EMS at the present moment represents

- about 60 member societies (55 full members, two associate, three reciprocal, one new application) and 2459 individual members
- 26 mathematical research centers and 15 other institutional members such mathematics departments and other scientific organizations
- 11 permanent committees dealing with various aspects of mathematician's life
- quadrennial congresses interlacing with the ICM
- coveted prizes regarded as a staple of quality
- journal and books coming from our publishing house

as well as numerous other activities which I shall now describe in more details

# Congresses

This was one of the first decision. The European Congress of Mathematics typically attracts around one thousand people.

- 1 ECM: Paris, July 6-10, 1992
- 2 ECM: Budapest, July 22-26, 1996
- 3 ECM: Barcelona, July 10-14, 2000
- 4 ECM: Stockholm, June 27 - July 2, 2004
- 5 ECM: Amsterdam, July 14-18, 2008
- 6 ECM: Krakow, July 2-7, 2012

The forthcoming 7th congress convenes at TU Berlin on July 18-22, 2016
http://www.7ecm.de/

For the congress in 2020 bids have been obtained from universities of Sevilla (Spain) and Primorska (Slovenia)

# Prizes

The renown of the EMS Prizes is seen from the fact that of the 60 laureates so far ten received subsequently the Fields medal:

- Richard Borchers 1992/1998
- Maxim Kontsevich 1992/1998
- Tim Gowers 1996/1998
- Grigory Perelman 1996/2006 (declined)
- Wendelin Werner 2000/2006
- Andrei Okounkov 2004/2006
- Elon Lindenstrauss 2004/2010
- Stanislav Smirnov 2004/2010
- Cédric Villani 2008/2010
- Artur Avila 2008/2014

In addition, we have brothers Lafforgue (one has the EMS Prize, one Fields) and combinations with other prestigious prizes

The EMS also awards Felix Klein Prize for the exceptional research in the area of applied mathematics and Otto Neugebauer Prize for the highly original and influential work in the field of history of mathematics

# EMS Committees

- Applied Mathematics
- Developing Countries
- Education
- Electronic Publishing
- ERCOM (European Research Centres in the Mathematical Sciences)
- Ethics
- European Solidarity
- Meetings
- Publications
- Raising Public Awareness
- Women in Mathematics

# ERCOM

Europe has probably the densest network of research centers in mathematics. They are very different; some have a significant permanent staff, some are 'conference factories' but they all keep very high scientific level. Here are some of them:

- Stefan Banach International Mathematical Center
- Centre International de Rencontres Mathématiques (CIRM)
- Erwin Schrödinger International Institute for Mathematical Physics
- Euler International Mathematical Institute
- The Abdus Salam International Centre for Theoretical Physics (ICTP)
- Institut des Hautes Études Scientifiques (IHES)
- Institut Mittag-Leffler
- Isaac Newton Institute for Mathematical Sciences
- and eighteen others

# Further EMS Activities

We support all sorts of mathematical activities having, for instance

- EMS Lecturers
- EMS Distinguished Speakers
- EMS Joint Mathematical Weekends
- EMS Summer Schools in Mathematics

cf. http://www.euro-math-soc.eu/news/13/01/10/call-proposals-scientific-activities-2016.
The applications are collected and evaluated by our meetings committee

At our webpage we also run a database of jobs in mathematics

## European Digital Mathematics Library (EuDML) Initiative

Mathematics literature is particular being, at least in principle, eternally valid. Europe is taking lead in making this treasure trove digitally accessible, https://eudml.org/

- Gateway to electronic publications and repositories of data providers
- 12 founding members: EMS, FIZ Karlsruhe, ICMCM Warsaw, U. of Grenoble, Czech Academy of Sciences, ... ,UMI
- Data, tools and services assembled or created in the EU funded EuDML project (2009-2013)
- Contribution to the World Digital Mathematics Library – a WG created in Seoul but the EuDML is for the moment the only functioning component, covering some 6% of the mathematics literature in the world

Another way in which care about mathematical literature is the Zentralblatt für Mathematik which we run together with Springer and FIZ Karlsruhe

# EU-MATHS-IN

Here is another initiative:

- A network of Mathematics for Industry and Innovation promoted by the EMS and ECMI (European Consortium for Mathematics in Industry), http://www.eu-maths-in.eu/

- Members are national networks in industrial mathematics: France, Germany, Austria, Italy, Spain, The Netherlands, UK, Ireland, Hungary, Czech Republic, Poland, Sweden, and Norway

- Service unit for exchanges of mathematical research and exploitation for innovation, industry, science and society

- Bridge between academic research groups and industry, with a European support

# EMS Publishing House

At the dawn of the millenium, the EMS started its own publishing house:

- presently it publishes 10-15 books per year and 19 journals

- among the journals we have our 'own', Journal of the EMS or JEMS which belongs to those with high reputation

- the EMS also publishes a Newsletter which offers a lot of interesting reading; its electronic version is freely available at http://www.ems-ph.org/journals/journal.php?jrn=news

- as the publishing house grows we formed recently a Scientific Advisory Board headed presently by Jakob Yngvason. It is our intention to make the enterprise stronger

# And this, of course, is not all

- we collaborate with the International Mathematical Union and mathematical societies and organizations around the world

- we are involved in high mathematical awards such as the Abel Prize and in various mathematical committees

- we are a part of CIMPA, the organization which helps mathematicians in the developing countries

- we use our influence for political lobbying in the European institutions in the interest of mathematics and science in general

- etc., etc.

# That much for mathematics

Let us now look for a recent European initiative
to support excellent science, namely the

European Research Council