

The increasing trend towards interdisciplinary research, reinforced by modern computer capabilities and rapid advances in pure and applied science, has prompted the MATHFSS project to examine how far mathematical concepts can elucidate important biological or man-made systems. Linking four leading European mathematical research centres, the project will define prospects and recommend curricula for future high-level research in key multi-factorial areas: neuroscience, systems biology, risk assessment, and digital content security.

## Numbers permeate life

A support project under the NEST initiative, MATHFSS is aiming to stimulate interaction between advanced research workers in four key areas where mathematics could have a newly prominent role in science and society. It will explore ways of training doctoral-level researchers in the application of maths approaches in emerging areas of systems biology, neuroscience, risk assessment and security of digital information. The project will also identify areas for research at the overlap between mathematics and appropriate areas of medicine and social science.

Because mathematical investigation of these areas is so new, bibliographic or other statistical information is unable to provide an insight into developing trends. Instead, MATHFSS will gather information and views from leading researchers through seminars and round-table discussions, inviting input from industry and political decision-makers, too. The conclusions will both assess the current scientific changes in the new topics, and provide a valuable basis for the planning of priorities for future research. The project will also promote collaboration between the main European mathematical research centres towards preparing innovative research programmes. It will communicate through the European

Research Centres on Mathematics (ERCOM) committee of the European Mathematical Society.

### Biological and man-made systems

MATHFSS aims to offer a short-cut between sophisticated mathematical approaches already being developed in Europe and new, multi-disciplinary areas with major research potential. Systems biology, for example, considers the multiple scales of biological systems – from the sub-cellular to the population level. Detailed measurement of the elements of a given system enables analysis of their behaviour, but also involves complex mathematics and transforms biology into bioinformatics. Neuroscience is an area where mathematical analysis will enhance understanding of how the brain handles sensory information and triggers cognitive responses. Normal and damaged mechanisms of selective attention and working memory – e.g. in schizophrenia and attention-deficit disorders – can be investigated using mathematical research to understand parameter dependencies.

Mathematical methods are also vital in the assessment of risk, both physical and economic. One of the main users here is





## MATHFSS NEST SUPPORT

*Neuroscience is an area where mathematical analysis will enhance understanding of how the brain handles sensory information and triggers cognitive responses.*

### AT A GLANCE

#### Official title

*Shaping new directions in mathematics for science and society*

#### Coordinator

*Spain: Centre de Recerca Matemàtica*

#### Partners

- *France: Institut des Hautes Études Scientifiques*
- *Israel: Emmy Noether Institute at Bar-Ilan University*
- *The Netherlands: European Institute for Statistics, Probability, Operations Research and their Applications*

#### Further information

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*24 months*

#### Project costs

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#### EU funding

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#### Project reference

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the insurance industry which needs to evaluate the probability, extent and effect of possible events. Risk assessment also covers survival models, prediction of extreme events, climate risk and robust product design – their determination is difficult but avoids costly failures. Finally, the proliferation of digital information applications through the internet, broadband and wireless networks involves new security concerns (e.g. access rights management and privacy protection) as well as improved public access to such information.

**The project will promote collaboration between the main European mathematical research centres, towards preparing innovative research programmes.**

applying a mathematical approach to problems in each area, and recommend common research topics for further study. Six of these meetings will incorporate a round-table discussion with participants from industry and government, to define

the main unsolved problems in each area and estimate their complexity. A special round table will be held at the International Congress of Mathematicians in 2006, covering all the subject areas considered in MATHFSS.

On completion, MATHFSS will be able to deliver a curriculum for doctoral

studies in each of the four areas and will disseminate the information gathered by all participants during the study period of 2005-6, through the project website, at public events and through a final book publishing its conclusions. Eventually the project will enable full use to be made of mathematical concepts and techniques in interdisciplinary work in the natural and social sciences, technology and economics.

### Meeting the academics

MATHFSS includes eight seminars designed to attract the most promising young researchers – two will be held in each of the four study areas and hosted by the participating organisations from Spain, France, Israel and the Netherlands. The fora will examine the potential for



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SIXTH FRAMEWORK PROGRAMME