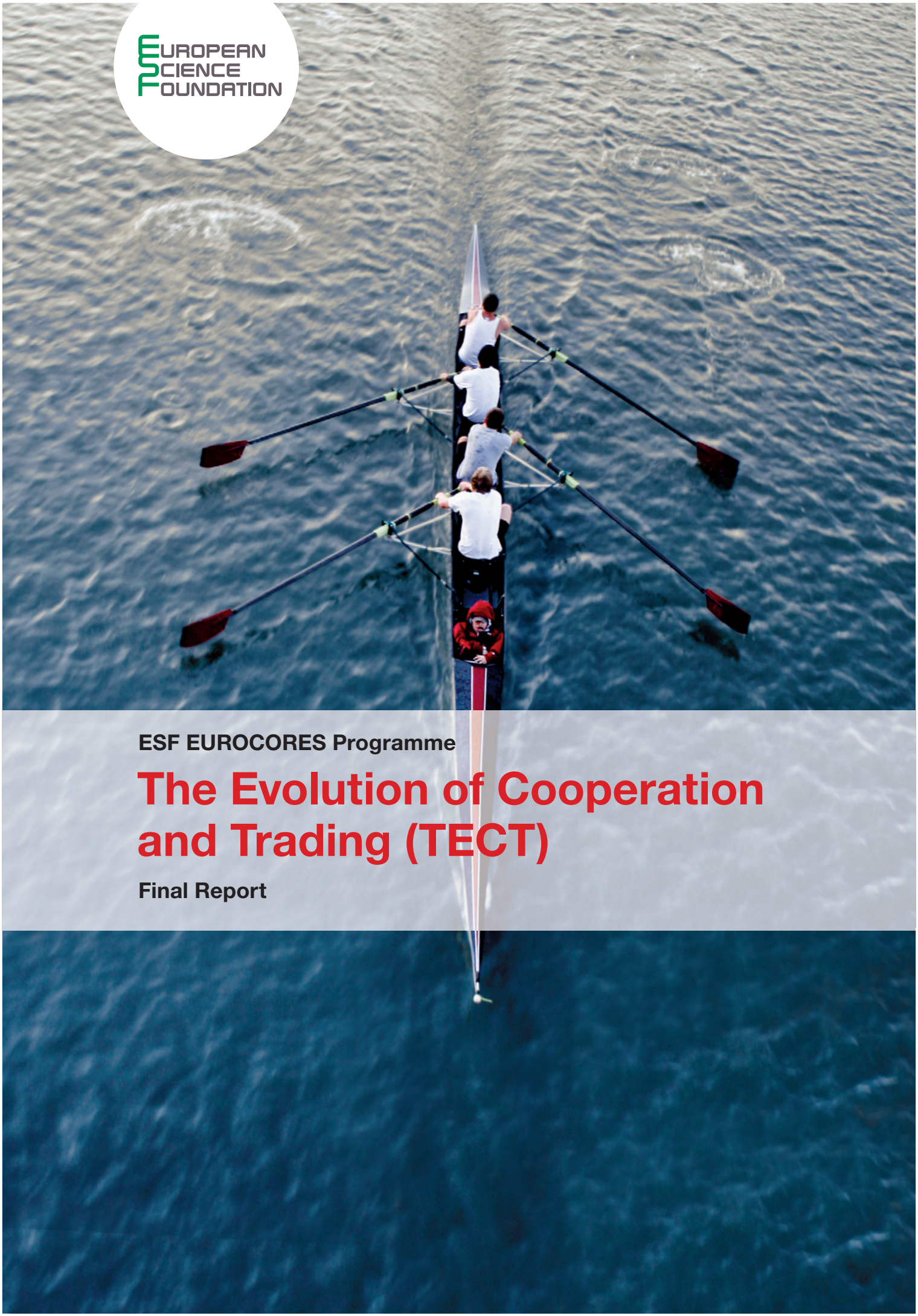

ESF EUROCORES Programme

The Evolution of Cooperation and Trading (TECT)

Final Report

European Science Foundation (ESF)

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Until the end of 2008, scientific coordination and networking was funded through the EC FP6 Programme, under contract no. ERASCT- 2003-980409. As of 2009, the national organisations support all aspects including scientific coordination, networking and research funding.

Editors
Dr Barry Dixon, Junior Science Officer
Dr Eva Hoogland, Senior Science Officer
Ms Claire Rustat-Flinton, Administrator

www.esf.org/tect

Contents

1. Introduction

Few phenomena attract as much attention from as many different scientific disciplines as the study of cooperation. Cooperation, sometimes disguised as 'reciprocal altruism', 'mutualism', 'symbiosis', 'reciprocity' or 'trading', is a central focus of inquiry (or is, at least, an important phenomenon) in many scientific disciplines such as anthropology, biology, economics, political science, psychology, sociology, history, artificial intelligence and robotics. Even fields that are less obviously related to behavioural phenomena, such as mathematics and chemistry, explore cooperative interactions.

This fascination with cooperation and its cousin, trading, rests on its puzzling nature: most forms of cooperation and trading are intrinsically unstable and theoretically problematic, yet it is hard to think of phenomena in nature and in human societies for which some form of cooperation does not play a role. Cooperation is at the centre stage in the evolution of life at all its levels, from the origins of the genetic code and multi-cellularity to the formation of social groups and the mutualistic interactions of members of different species. Cooperation is an essential ingredient at all levels of human societies too, from neighbours helping each other to alliances between nation states. One could say that complex forms of cooperation involving large numbers of unrelated individuals, sometimes collectively referred to as 'social dilemmas', are as 'uniquely human' as language is. The phenomenon making all these forms of cooperation so interesting is the risky investment cooperating agents and traders typically have to make in order to have a fair chance of reaping the benefits of cooperation.

Cooperative strategies fall roughly into two categories: those that are the product of evolutionary processes, be they natural or cultural, and those that are the result of cognitive processes. The first have been under selective pressure over countless generations and are likely to be more 'rational' than those resulting from cognitive processes. The *raison d'être* of cognitive strategies is their much greater flexibility in novel situations. Inherited cooperative strategies are not well-suited for use in variable environments and under unpredictable circumstances. Cognitive processes, however, require costly structures, such as brains, and are slow compared to hard-wired strategies. Therefore, cooperation strategies based on rules-of-thumb are likely to prevail as long as they do well enough most of the time.

The idea of developing a EUROCORES research programme on these topics came after a number of successful interdisciplinary meetings, the core of which was formed by anthropologists, biologists, economists and psychologists, sharing a common interest in the evolution of strategies that facilitate cooperation. The most important of these meetings was the 90th Dahlem Workshop on Genetic and Cultural Evolution of Cooperation, held in Berlin in June 2002, which led to the publication of a book edited by Peter Hammerstein under the same title (*Genetic and Cultural Evolution of Cooperation*. Cambridge, Mass,: MIT Press, 2003). This book reflects the state of the art at the time I assembled a group of 24 scientists from 11 European countries, and at least as many disciplines, and proposed this programme. We decided to use both the words 'cooperation' and 'trading' in the programme's title to stress that we were not only talking about a biological concept, as the term 'evolution' would suggest to some, but also about human interactions as seen through the eyes of anthropologists, economists, historians, psychologists and sociologists.

The hypothesis underlying TECT is that agents

of a different nature, ranging from bacteria to nation states, are likely to be equipped with similarly evolved strategies designed to solve the same recurring dilemmas. While distantly related species probably use different mechanisms to implement these strategies, more closely related species are more likely to employ the same mechanisms when solving the same problems. The Call for Proposals, which solicited interdisciplinary research and the promotion of links between empirical and theoretical work, resulted in a high number of excellent proposals. Five collaborative research projects (CRPs) were funded from the summer of 2007 to the autumn of 2010, most of which included researchers from outside Europe too. These five CRPs were united around one main goal, namely highlighting the evolutionary continuity of cooperation, both genetic and cultural, and making this continuity an object of study in its own right: What causes the evolution of different mechanisms and strategies? Can we trace the evolutionary history of cooperative mechanisms and does this explain the forms of cooperation we observe today? Can 'bounded rationality' and the breakdown of cooperation in modern human societies be explained by the activation of mechanisms that evolved in past environments? Does evolutionary history repeat itself in the form of a cultural evolution of human trading behaviour? Another important goal of our programme, essential to achieving the first, was to bring together experts from different disciplines in order to encourage 'cross-fertilisation' of different traditions, terminologies and methods.

Apart from generating and catalysing a great number of highly interesting research projects, TECT made possible the organisation of a series of very successful meetings. At the start of the programme these were instrumental in getting the CRPs organised and members of different disciplines used to each other's methods, jargon and hobby horses. The multidisciplinary character of TECT was evident from the rich mix of scientific disciplines represented during its general assemblies at the start and end of the programme as well as the theory-oriented meeting 'Evolution of Cooperation' held at IIASA in Austria in September 2009. Two highly successful summer schools, again with teachers and students from many different disciplines, completed the scope of the programme by bridging the gap between established scientists and those arriving new on the stage.

The run-up to a EUROCORES programme may be demanding, but once a programme is established one is rewarded by the support of the highly efficient and professional staff of the ESF. Combined with simple and straightforward administrative procedures, this makes EUROCORES programmes oases in the European desert.

Overall, TECT proved to be one big experiment in cooperation: cooperation at the procedural level between numerous funding agencies, as well as cooperation at the scientific level among a large and varied scientific community. While TECT may not have found an optimal solution for this coordination game, and some efforts have not been proportionally rewarded, many – including the younger generation of scholars – have benefitted from the programme and left with ample gains.

Professor Ronald Noë
Faculté de Psychologie, Université de Strasbourg et Éthologie Évolutive (DEPE-IPHC), CNRS, France
Chair of the TECT Scientific Committee

2.
The Collaborative Research Projects (CRPs)

The EUROCORES Programme TECT was comprised of the following five collaborative research projects (CRPs), bringing together researchers from across Austria, France, Hungary, Italy, the Netherlands, Portugal, Spain and the United States.

Cooperation in Mutualisms: contracts, markets, space and dispersal (BIOCONTRACT)

National Projects:
Austria, France, Hungary, Portugal, United States
Project Leader:
Professor Naomi Pierce,
Harvard University, USA

An example of an ant-plant mutualistic interaction (ants protecting the new shoot of a host plant).

Individual Projects:

- **Applying the Economics of Information to Mutualisms**

  Principal Investigators:
  Professor Drew Fudenburg,
  Professor Jerry Green and
  Professor Naomi Pierce
  Funding agency:
  National Science Foundation (NSF), United States

  Project members directly funded under TECT:
  Dr Marco Archetti, *postdoctoral researcher*
  Project members not directly funded under TECT:
  Mr Christopher Baker, *postgraduate researcher,*
  Dr Megan E. Frederickson, *postdoctoral researcher,*
  Dr Gabriel Miller, *postdoctoral researcher,*
  Dr David Rand, *postdoctoral researcher,*
  Dr Glen Weyl, *postdoctoral researcher*

- **The Adaptive Dynamics of Mutualism: Spatial Games, Origins and Diversification**

  Principal Investigator:
  Professor Ulf Dieckmann
  Funding agency:
  Austrian Science Fund (FWF), Austria

  Project members:
  The research for this project is based on international collaborations with researchers from the following departments:
  Department of Evolutionary Studies of Biosystems, Graduate University for Advanced Studies (SOKENDAI), Hayama, Japan
  Biometris, Department of Mathematical and Statistical Methods, Wageningen University, the Netherlands
  Department of Mathematics and Mathematical

Statistics, Umeå University, Sweden
Department of Plant Taxonomy and Ecology, Loránd Eötvös University, Budapest, Hungary

- **Spatial Games and Mutualism between Bacteria and their Plasmids**

Principal Investigator:
Professor Francisco Dionisio
Funding agency:
Foundation for Science and Technology (FCT), Portugal

Project members not directly funded under TECT:
Dr Luís M. Carvalho, *postdoctoral researcher,*
Ms Iolanda Domingues, *postgraduate researcher*

- **Spatial Games and Mutualism between Ants and Plants**

Principal Investigator:
Dr Jérôme Orivel
Funding agency:
National Centre for Scientific Research (CNRS), France

Project members not directly funded under TECT:
Dr Hervé Gryta, *senior scientist,*
Dr Patricia Jargeat, *senior scientist*,
Dr Nathalie Séjalon, *senior scientist*,
Dr Alain Jauneau, *research engineer*,
Dr Céline Leroy, *postdoctoral researcher*,
Dr Mario-Xavier Ruiz-Gonzalez, *postdoctoral researcher*,
Mr Pierre-Jean Malé, *postgraduate researcher*

- **Applying Spatial Games to Empirical Systems**

Principal Investigator:
Dr Istvan Scheuring
Funding Agency:
Hungarian Scientific Research Fund (OTKA), Hungary

Project members directly funded under TECT:
Dr Gergely Boza,
Dr András Szilágyi
Project members not directly funded under TECT:
Dr Ádám Kun

Associated Projects:

- **Spatial Games and Mutualism between Ants and Plants**

Associated Partner:
Dr Douglas W. Yu

Project members: none

Allo-preening in ravens, *Corvus corax*. Analogue to grooming in primates, this behaviour is used to form and maintain close social bonds. © Christian Schloegl

Cooperation in Corvids (COCOR)

National Projects:
Austria, France, Italy, the Netherlands, Spain
Project Leader:
Professor Ronald Noë,
University of Strasbourg

Individual Projects:

- **Cooperation and Economic Behaviour in Rooks (*Corvus frugilegus*)**

Principal Investigator:
Professor Ronald Noë
Funding agency:
National Centre for Scientific Research (CNRS), France

Project members not directly funded under TECT:
Ms Delphine Réminiac, *project coordinator*,
Ms Stéphanie Brunel, *postgraduate researcher*,
Ms Laureline Durand, *postgraduate researcher*,
Mr Thomas Hindelang, *postgraduate researcher*,
Ms Christelle Scheid, *postgraduate researcher*,
Ms Aurore Wild, *postgraduate researcher*,
Ms Melanie Krieger, *visiting postgraduate researcher*,
Ms Felice di Lascio, *visiting postgraduate researcher*,
Ms Judith Schmidt, *visiting postgraduate researcher*,
Ms Christine Schwab, *visiting postgraduate researcher*

Third-party interaction in common ravens, *Corvus corax*. One raven (middle) is supporting his close friend (right) in competition with another raven (left) for a toy object. © Thomas Bugnyar

- **Cooperation and Cognition in a Variable Social Environment**

  Principal Investigator:
  Dr Vittorio Baglione
  Funding agency:
  Interministerial Commission of Science and Technology (CICYT), Spain

  Project members: none

- **Affiliate Relations and Cooperation in Ravens, *Corvus corax***

  Principal Investigator:
  Dr Thomas Bugnyar
  Funding agency:
  Austrian Science Fund (FWF), Austria

  Project members directly funded under TECT:
  Mr Laurent Amman, *postgraduate researcher*
  Mr Markus Boeckle, *postgraduate researcher*
  Dr Orlaith Fraser, *postdoctoral researcher*
  Ms Essi Kaartinen, *postgraduate researcher*
  Ms Melanie Krieger, *postgraduate researcher*
  Mr Alexandru Munteanu, *field assistant*
  Ms Georgine Szipl, *field assistant*
  Ms Claudia Washer, *field assistant*
  Project members not directly funded under TECT:
  Ms Anna Braun, *postgraduate researcher*,
  Ms Felice di Lascio, *postgraduate researcher*,
  Mr Matthias-Claudio Loretto, *postgraduate researcher*,
  Mr Francois Nyfeller, *postgraduate researcher*,
  Dr Christian Schloegl, *postdoctoral researcher*,
  Dr Christine Schwab, *postdoctoral researcher,*
  Ms Zsofia Gergely, *field assistant*

- **Modelling the Biological and Neurological Basis of Cooperation in Birds with Collective and Evolutionary Robotics Techniques**

  Principal Investigator:
  Professor Orazio Miglino
  Funding agency:
  National Research Council (CNR), Italy

  Project members: none

- **The Economics of Cooperation in Humans and Crows: a Comparative Approach**

  Principal Investigator:
  Professor Eric E.C. van Damme
  Funding agency:
  Netherlands Organisation for Scientific Research (NWO), the Netherlands

  Project members not directly funded under TECT:
  Ms Marta Serra-Garcia, *postgraduate researcher*

Associated Projects:

- **Relationship Intelligence and Cooperative Cognition in Rooks and Jackdaws**

  Associated Partners:
  Dr Nathan J. Emery

  Project members: none

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Dynamic Complexity of Cooperation-Based Self-Organising Networks in the First Global Age (DynCoopNet)

National Projects:
Portugal, Spain, United States
Project Leaders:
Dr Ana Crespo Solana and
Professor J.B. (Jack) Owens

Individual Projects:

Principal Investigator:
Dr Ana Crespo Solana
Funding agency:
Interministerial Commission of Science and Technology (CICYT), Spain

Dr Ana Crespo Solana at a meeting at the International Congress 'Oceans Connect', Hyderabad, India, 1 January 2010.
© Ernie Alconchel Guido.

Project members directly funded under TECT:
Mr Roberto Maestre, *GIS technician*,
Mr Juan Manuel Sánchez-Crespo Camacho, *research assistant*
Project members not directly funded under TECT:
Ms Esther Pérez Asensio, *GIS technician*,
Ms Isabel del Bosque, *GIS Manager*,
Professor Maurits Ebben, *collaborative research partner*,
Professor Sean Perrone, *collaborative research partner*,
Professor Margrit Schulte Beerbühl, *collaborative research partner,*
Professor Monica Wachowicz, *collaborative research partner*,
Dr Klaus Weber, *collaborative research partner*,
Dr Marta García Garralón, *postdoctoral researcher*,
Dr Montserrat Cachero Vnuesa, *postdoctoral researcher*

Members of Dr Crespo's team in the CSIC, Madrid: Ms Esther Pérez Asensio, Mr Juan Manuel Sánchez-Crespo Camacho and Mr Roberto Maestre Martínez.
© Ana Crespo Solana

Professor Miguel Ángel Bernabé and Professor Monica Wachowicz attending a session in the Launch Conference, Collegium Budapest, Institute for Advanced Study, Budapest, Hungary, 4-7 July 2007.
© Ana Crespo Solana

Principal Investigator:
Professor Miguel Ángel Bernabé Poveda
Funding agency:
Interministerial Commission of Science and Technology (CICYT), Spain

Project members not directly funded under TECT:
Dr María José García González, *scientific coordinator*,
Dr Argentina Sampaio, *technical and financial administrator*,
Professor Miguel Ángel Manso Callejo, *collaborative research partner*,
Mr Alberto Fernández-Wyttenbach, *postgraduate researcher*,
Ms Ana Galindo, *postgraduate researcher,*
Ms Marta Guerrero-Nieto, *postgraduate researcher*,
Ms Teresa Iturrioz-Aguirre, *postgraduate researcher*,
Mr Daniel Orellana, *postgraduate researcher*,
Mr Willington Siabato, *postgraduate researcher*,
Mr Adolfo Urrutia-Zambrana, *postgraduate researcher*

Principal Investigator:
Dr David Alonso García
Funding agency:
Interministerial Commission of Science and Technology (CICYT), Spain

Project members not directly funded under TECT:
Professor Eulalia Ruiz Palomeque, *collaborative research partner*,
Ms Marta Sanz Prieto, *collaborative assistant*

Principal Investigator:
Dr Vicente Montojo Montojo
Funding agency:
Interministerial Commission of Science and Technology (CICYT), Spain

Project members: none

Principal Investigator:
Dr Antoni Picazo Muntaner
Funding agency:
Interministerial Commission of Science and Technology (CICYT), Spain

Project members: none

Principal Investigator:
Professor J.B. Owens
Funding agency:
National Science Foundation (NSF), United States

Project members directly funded under TECT:
Mr Robert Hibbert, *research assistant*,
Mr Anderson Sandes, *research assistant*,
Mr Derrick Sharp, *research assistant*
Project members not directly funded under TECT:
Mr Alasdair Anderson, *collaborative research partner*,
Professor Cátia Antunes, *collaborative research partner*,
Dr Amândio Jorge Morais Barros, *collaborative research partner*,
Professor Margrit Schulte Beerbühl, *collaborative research partner*,
Dr Nuno Camarinhas, *collaborative research partner*,
Professor Joaquim Carvalho, *collaborative research partner*,
Professor Ricardo Court, *collaborative research partner*,
Dr Aldo Gangemi, *collaborative research partner*,
Dr Ian Johnson, *collaborative research partner*,
Professor Jean-Paul Le Flem, *collaborative research partner*,
Professor Gesa Lindemann, *collaborative research partner*,
Professor Sean Perrone, *collaborative research partner*,

The historians of the DynCoopNet team during the TECT Launch Conference, Budapest, Hungary, 4-7 July 2007: (from left to right) Professor Amélia Polonia Da Silva, Professor Rila Mukherjee, Professor Hilario Casado, Professor Jack Owens, Dr David Alonso García, Dr Amandio Barrios, Dr Carlos Álvarez Nogal, Dr Ana Crespo Solana and Dr Vicente Montojo. © Ernie Alconchel Guido

Dr Jessica Roitman, *collaborative research partner*,
Dr Myriam Senn, *collaborative research partner*,
Professor Ference (Szidar) Szidarovszky, *collaborative research partner*,
Professor Monica Wachowicz, *collaborative research partner*

Professor Amélia Polonia Da Silva and Ms Ana Sofía Ribeiro at the final meeting in Budapest, 15-17 September 2010
© Winfried Heinemann

Principal Investigator:
Professor Amélia Polónia da Silva
Funding agency:
Foundation for Science and Technology (FCT), Portugal

Project members directly funded under TECT:
Ms Sara Pinto Costa, *postgraduate researcher*,
Ms Ana Sofia Ribeiro, *postgraduate researcher*,
Mr João Carvalho, *web designer and database specialist*,
Ms Sandra Brito, *data base management and researcher*
Project members not directly funded under TECT:
Professor Cátia Antunes, *collaborative research partner*,
Dr Nuno Camarinhas, *collaborative research partner*,
Professor Maria Helena Cardoso Osswald, *collaborative research partner*,
Professor Joaquim Carvalho, *collaborative research partner*,
Ms Teresa Iturrioz-Aguirre, *collaborative research partner*,
Dr Amândio Jorge Morais Barros, *collaborative research partner*,
Mr Fernando Miguel Moreira Nogueira, *collaborative research partner*,
Professor Jorge M. Pacheco, *collaborative research partner*,
Mr Flávio Pinheiro, *collaborative research partner*,
Dr Francisco Santos, *collaborative research partner*,

Professor Margrit Schulte Beerbühl, *collaborative research partner*,
Professor Monica Wachowicz, *collaborative research partner*

Associated Projects:

Associated Partners:
Dr Carlos Álvarez Nogal,
Professor Hilario Casado Alonso,
Dr T. Matthew Ciolek,
Dr Emery Coppola Jr,
Professor Juan Gelabert González,
Professor Rila Mukherjee,
Professor Sara T. Nalle,
Professor Tönu Puu,
Professor Michael Sonis,
Dr Shahriar Yousefi,
Professor May Yuan,
Professor Benigna Zimba

Sustaining Eco-economic Norms for a Sustainable Environment (SENSE)

National Projects:
Austria, the Netherlands, United States
Project Leader:
Professor Simon A. Levin, Princeton University, United States

Individual Projects:

- **Altruistic Punishment**

Principal Investigator:
Professor Karl Sigmund
Funding agency:
Austrian Science Fund (FWF), Austria

The Masai herding cattle. Adding more cattle to the landscape than it can handle leads to the tragedy of the commons.

Project members directly funded under TECT:
Dr Dirk Semmann, *postdoctoral researcher*,
Ms Eva van den Broek, *postgraduate researcher*,
Mr Christian Hilbe, *postgraduate researcher*

- **The Roles of Social Structure and Social Norms on the Evolution of Cooperation**

Principal Investigators:
Professor Simon Levin,
Professor Daniel Rubenstein

Project members: none
This grant was not eventually awarded

- **Cooperation at National and International Levels**

Principal Investigator:
Professor Aart de Zeeuw
Funding agency:
Netherlands Organisation for Scientific Research (NWO), the Netherlands

Project members directly funded under TECT:
Dr Marius I. Ochea, *postdoctoral researcher*

The Social and Mental Dynamics of Cooperation (SOCCOP)

National Projects:
France, Hungary, Italy, Spain, United States
Project Leader:
Professor Herbert Gintis, *Central European University (CEU), Budapest, Hungary*

Individual Projects:

- **A Framework for the Unification of Behavioural Sciences**

Principal Investigator:
Professor Herbert Gintis
Funding agency:
Hungarian Scientific Research Fund (OTKA), Hungary

Professor Gintis (left), alongside Professor Dieckmann (centre) and Professor Owens (right) at the Laxenburg workshop, 'Evolution of Cooperation: Models and Theories', September, 2009.
Reproduced with permission from the International Institute for Applied Systems Analysis (IIASA)

Project members directly funded under TECT:
Ms Emma Einhorn, *research assistant*
Ms Yusuke Narita, *research assistant*,

- **Institutional Niche Construction and the Evolution of a Cooperative Species**

Principal Investigator:
Professor Samuel Bowles
Funding agency:
National Science Foundation (NSF), United States

Project members: none

- **Proximate Explanations for Human and Animal Cooperation**

Principal Investigator:
Professor Cristiano Castelfranchi
Funding agency:
National Research Council (CNR), Italy

Project members directly funded under TECT:
Dr Gloria Sabbatini, *postdoctoral researcher*,
Dr Gennaro di Tosto, *postdoctoral researcher*,
Dr Luca Tummolini, *postdoctoral researcher*,
Project members not directly funded under TECT
Dr Giulia Andrighetto, *postdoctoral researcher*,
Professor Rosaria Conte, *senior researcher*,
Professor Ugo Pagano, *senior researcher*,
Ms Eugenia Polizzi di Sorrentino, *postgraduate researcher*,
Dr Gabriele Schino, *senior researcher*,
Dr Elisabetta Visalberghi, *senior researcher*,
Dr Francesca Giardini, *postdoctoral researcher*

- **High-level Neuronal Architectures for Cooperation and Communication**

Principal Investigator:
Professor Michel Kerszberg
Funding agency:
National Centre for Scientific Research (CNRS), France (due to the ill-health of the Principal Investigator, this project did not proceed)

Project members: none

Two Capuchin monkeys foraging

- **The Behavioural Genetics of Trade and Cooperation**

Principal Investigator:
Professor Arcadi Navarro
Funding agency:
Interministerial Commission of Science and Technology (CICYT), Spain

Project members directly funded under TECT:
Dr Fleur Darre, *postdoctoral researcher*,
Dr Elodie Gazave, *postdoctoral researcher*,
Mr Fernando Muñiz, *technician*

Professor Navarro's team. © Arcadi Navarro

- **In Silico Evolution of Cooperation and Communication**

  Principal Investigator:
  Professor Eörs Szathmáry
  Funding agency:
  Hungarian Scientific Research Fund (OTKA), Hungary
  Project members: none

Associated Projects:

- **The Behavioural Genetics of Risk, Time and Social Preferences**

  Associated Partner:
  Professor Ernst Fehr
  Project members not directly funded under TECT:
  Dr Thomas Baumgartner, *senior researcher*,
  Dr Daria Knoch, *senior researcher*,
  Dr Daniel Schunk, *senior researcher*,
  Dr Christoph Eisenegger, *researcher*

- **Metacognition and Decision Making Under Risk: Individuals and Groups**

  Associated Partner:
  Professor Alex Kacelnik
  Project members: none

- **The Development of Cooperative Norms**

  Associated Partner:
  Professor Ruth Mace
  Project members: none

- **The Evolution of Moral Behaviour**

  Associated Partner:
  Dr Robert Rowthorn
  Project members: none

3.
Facts and Figures

3.1 Research Funding

Research funding was generated from seven European funding agencies and the National Science Foundation of the United States, through the European Science Foundation (ESF). The selection of project proposals was achieved through a two-stage process, with outline proposals being sifted by the international TECT Review Panel (which included leading academics from ten European countries, the United States, Canada and India), and full proposals for collaborative research projects (CRPs) being selected by the Review Panel on the basis of reports submitted by international expert referees.
Eventually, out of the 21 outline proposals for collaborative research projects, five CRPs obtained funding, which included 26 individual project teams (though one of these teams eventually did not receive its funding so was forced to withdraw from the programme) and 18 associated partners. The duration of projects was between three and four years, depending on the funding granted under national rules and regulations.

The following funding agencies supported the 25 projects over the five collaborative research projects in the EUROCORES programme TECT: *Austrian Science Fund* (FWF), *National Centre for Scientific Research* (CNRS), *Hungarian Scientific Research Fund* (OTKA), *National Research Council* (CNR), *Netherlands Organisation for Scientific Research*

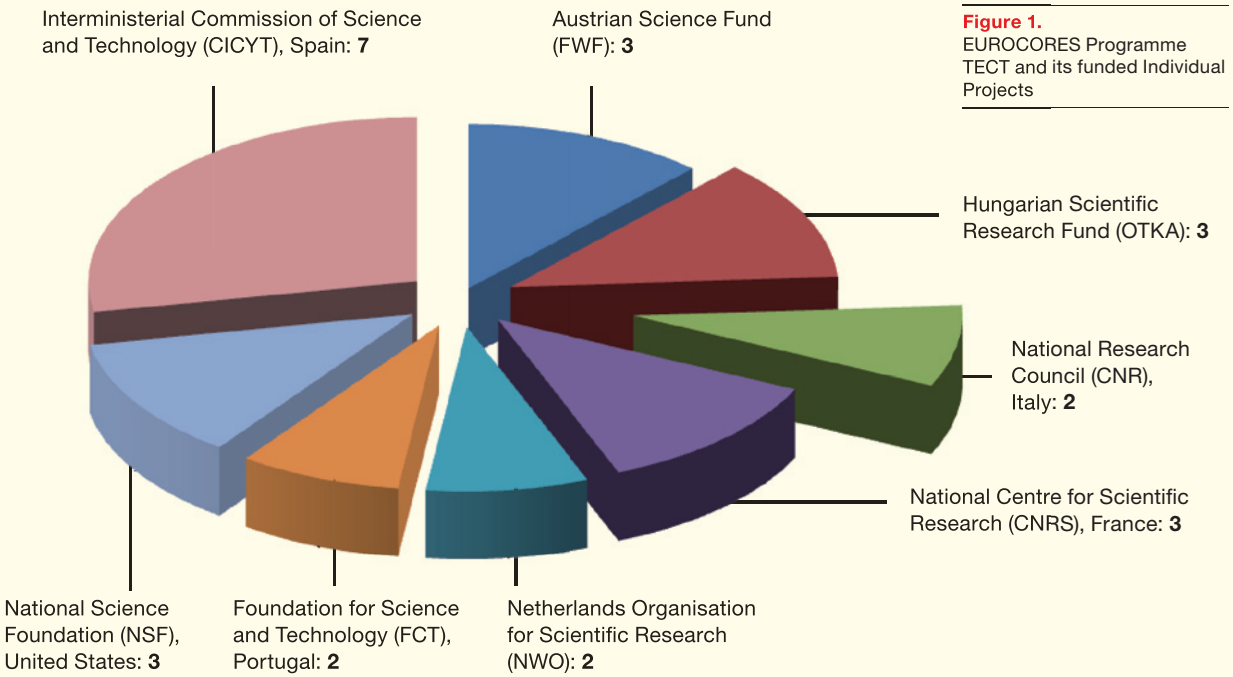


Figure 1.
EUROCORES Programme TECT and its funded Individual Projects

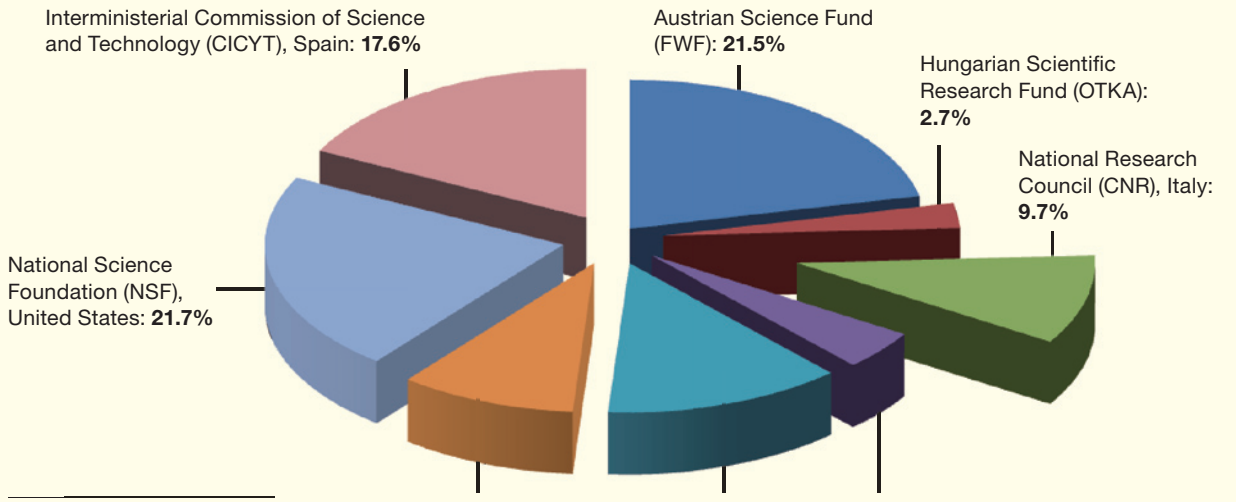


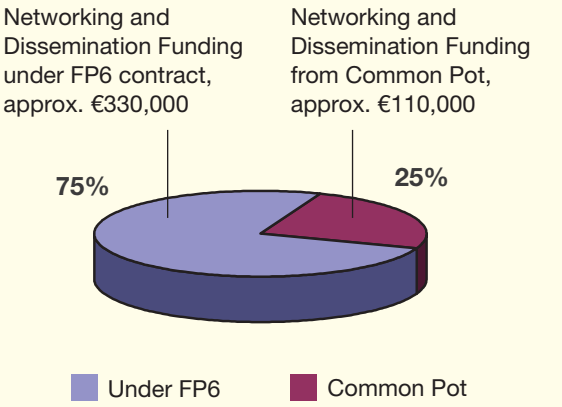
Figure 2.
EUROCORES Programme
TECT Research Funding

(NWO), *Foundation for Science and Technology* (FCT), *Interministerial Commission of Science and Technology* (CICYT), *National Science Foundation* (NSF).

The research budget granted by national funding agencies participating in the EUROCORES programme TECT exceeded 3 M€. The graphics analyse the number of funded TECT projects per funding agency (see Figure 1) and the proportion of the research budget allocated by national funding agencies to the TECT projects in the context of the general research budget (see Figure 2).

3.2 Networking and Dissemination Funding

TECT networking activities were collaborative activities (*e.g.* workshops, conferences, summer schools, etc.) that brought together scientists from at least two collaborative research projects and, on occasion, external experts in order to discuss, plan and implement future collaboration and interaction. Until the end of 2008, coordination and networking by the European Science Foundation was covered through the EC FP6 Programme, under contract number ERASCT-2003-980409. Since January 2009, national funding agencies participating in EUROCORES programmes have provided the networking budget on the principle of a common pot. The TECT networking funding also covered dissemination activities that were intended to deepen the impact of the research and strengthen the field by facilitating the dissemination of results while raising the profile of the EUROCORES Programme TECT as a whole. In terms of the total amount of funding for networking and dissemination activities, approximately 75% was allocated through the FP6 contract, with the remaining 25% coming from the common pot.



3.3 Networking and Dissemination Activities

Networking and collaboration within a EUROCORES Programme take place at two levels: between the various Individual Projects within each collaborative research project (CRP), and between the funded CRPs within the programme as a whole.
The intra-CRP collaboration is motivated by the nature of the CRP's research objectives, *i.e.*, by the scope and the complexity of the questions it deals with. In a CRP, the participating groups have the

opportunity to gather the required critical mass to successfully address the objectives and challenges of their project.

The cross-CRP networking and collaboration – more on which you will find in this chapter – is stimulated by the aims and the nature of a particular EUROCORES programme. The TECT programme has been developed precisely because of the clear need for enhanced collaboration in this field. The funded CRPs have collectively set up and further streamlined this new collaboration. To this end, the CRPs have engaged their members and, when of clear benefit, colleagues from outside the programme, in joint activities such as seminars, workshops, expert meetings, conferences and training activities – either as stand-alone or as part of other larger events.

Through the active participation of scientists in the above-mentioned activities, not only have existing collaborations been enhanced, but also new and strategic partnership opportunities have been identified. Furthermore, these activities provided opportunities to explore aspects of the TECT programme which are not covered by the funded research projects.

The integrative activities between the CRPs have helped to strengthen the field by building coherence within this emerging research community, and served as a platform for the research work which is done in the programme.

Further information can be found at the programme website www.esf.org/tect by clicking on Events.

The following activities were organised and funded through the TECT networking and dissemination budget:

- **TECT Launch Conference**
  4-7 July 2007, Collegium Budapest, Institute for Advanced Study, Hungary

The Launch Conference was a major networking occasion that brought together researchers from all collaborative research projects (CRPs) involved in the TECT Programme, members of the TECT Review Panel, proposers of the initiative and participants of the original planning meetings from which the TECT programme emerged, as well as other specially invited guests from related networks.

- **Workshop 'Studying Challenges of the Global Commons: connecting researchers with complementary interests'**
  5-7 September 2007, Stockholm, Sweden

The aim of this workshop was to present ideas on the evolution of cooperation in relation to problems of managing the global commons. Project members focused on unravelling rules that govern the evolution of human cooperative behaviour and on different issues of the development of norms, their enforcement and what distinguishes situations in which trust and cooperation build from those in which cooperation breaks down or never develops.

- **Dissemination Activity at Workshop 'GIS in Historical Research'**
  24 October 2007, King's College London, UK

Geographical Information Systems (GIS) are becoming increasingly used by historians, archaeologists and others with an interest in the geographies of the past. To date take-up has been hampered by a lack of understanding of what GIS is and what it has to offer to these disciplines. This workshop provided

Some of the participants of the Launch Conference. From left to right: Professor Melinda Laituri, Dr Shariar Yousefi, Professor Tõnu Puu, Professor Sara T. Nalle, Dr Amandio Barrios, Professor Hilario Casado Alonso, Dr Emery Coppola Jr, Dr David Alonso García, Dr Carlos Álvarez Nogal, Dr Antoni Picazo Muntaner, Professor Amélia Polonia da Silva, Professor Monica Wachowicz, Professor Rila Mukherjee, Professor May Yuan; and kneeling from left to right: Professor Miguel Ángel Bernabé Poveda, Dr T. Matthew Ciolek, Dr Ana Crespo Solana. © Ernie Alconchel Guido

a basic introduction to GIS both as an approach to academic study and as a technology.

- **Poster 'Cooperation and Trading in the First Global Age, 1400-1800: An Application of Geographic Information Systems (GIS)' at the Annual Meeting of the American Historical Association (AHA)**
  3-6 January 2008, Washington D.C., USA

The poster presented at one of the largest meeting of historians in the world (5,000 participants) aimed to attract the attention of the wider scientific public to Geographic Information Systems (GIS).

- **Workshop 'Towards a Unifying Theory of Cooperation and Mutualism'**
  8-11 January 2008, Oeiras, Portugal

Cooperative interactions occur in both sentient and non-sentient organisms. Typically, different sets of models are used to explain cooperation in each domain. However, the workshop participants intended to explore how the concept of Partner Choice can be applied to cooperation across the gradient of sentience.

Participants from the workshop in Oeiras. © Ronald Noë

- **Dissemination of TECT to the Forum on European Expansion and Global Interaction (FEEGI)**
  22-23 February 2008, Georgetown University, Washington D.C., USA

This TECT dissemination activity at an international conference provided an excellent opportunity to present TECT projects as tools and means on how to approach the classic subjects of European Expansion in a different way, and presented TECT's innovative theoretical focus and methodological approaches based on multidisciplinary teams.

- **Workshop 'Trust, Reputation, Defectors and Sustaining Social Norms: studying spatially complex relationships in ways that connect TECT projects'**
  26-29 March 2008, Porto, Portugal

In March 2008, the University of Porto in Northern Portugal hosted a joint-project workshop of the TECT programme that was dedicated to important aspects of cooperation research: trust, reputation, defectors and sustaining social norms. This networking activity advanced the study of spatially complex cooperative relationships in ways that connect TECT projects and transform academic disciplines.

The participants of the Barcelona workshop. © Arcadi Navarro

- **Workshop 'The Social and Psychological Dynamics of Cooperation and Punishment'**
  25-27 April 2008, Barcelona, Spain

This strategic symposium brought together members of three TECT collaborative research projects, representatives of other TECT projects and leading researchers interested in the temporal aspects of social and mental dynamics of cooperation. Members of the different teams presented ideas on the evolution of cooperation over time, since the late Pleistocene and early Holocene up to today and across different extant societies.

- **Summer School 'Tools of the Trade in Cooperation Research'**
  30 August – 6 September 2008, Obernai, France

This summer school was part of two European research programmes that centre on the study of the phenomenon 'cooperation': TECT and INCORE. The goals of the summer school were the strengthening of theoretical and methodological knowledge, the improvement of ongoing projects, but above all exchanges between teachers and students from different disciplines.

Professor Owens lecturing at the summer school, Obernai. © Ronald Noë

- **Workshop 'Visualisation and Space-Time Representation of Dynamic, Nonlinear, Spatial Data in DynCoopNet and Other TECT Projects'**
  September 2008, Madrid, Spain

The workshop aimed to provide a unique forum for discussion about space, time and mobility of self-organising cooperation networks of the First Global Age based on different perspectives from geographic information scientists, historical geographers, cartographers, geomatics engineers and computer scientists. As a part of its research programme, DynCoopNet places special emphasis on the use of historic cartography as a data source about cognitive understandings of space and their relationship to cooperation in trading activity.

- **Strategic Symposium 'Money, Altruism and Genes: Exploring the Genetic Basis of Cooperative and Commercial Behaviours'** including the workshop **'Genetic Basis of Coalition Formation in Non-human Primates' and** in conjunction with **TECT Scientific Committee Meeting (22 November) and TECT General Meeting (22-23 November)**
  20-23 November 2008, Barcelona, Spain

This series of events brought together members of several of the CRPs, as well as many leading researchers interested in the various aspects of cooperation.

In terms of the scientific content, just some of the topics covered included coalition formation in baboons and macaques, the genetic basis of cooperation, the link of genetics research to the field of neuroimaging, as well as discussion of sacred values, a subject area which included talks by Professors Tobeña and Attran on the genesis of suicide terrorists, and Lord John Alderdice on the peace process in Northern Ireland.

The meeting of the TECT Scientific Committee and assembly, meanwhile, allowed members to update each other on the progress of their CRPs during the year and to start devising plans for future collaborative efforts.

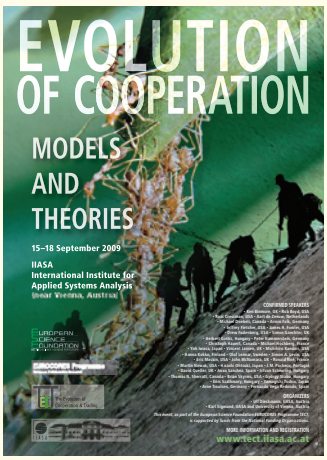
- **Workshop 'Mutualism: Plants and the Evolution of Cooperation and Trading'**
  7-9 May 2009, Harvard University, Cambridge, USA

Members of three TECT collaborative research projects, BIOCONTRACT, SENSE and COCOR, gathered together for a workshop at Harvard University on 7-9 May 2009. The theme of the workshop was 'The Evolution of Mutualism', and was combined with a separately organised symposium on 'Plants and the Evolution of Cooperation & Trading' sponsored by Harvard's Plant Biology Initiative. The three TECT CRPS share an interest in cooperation among non-relatives and in mechanisms of policing and/or punishment that can help enforce cooperation. Mutualism, or cooperation among species, cannot be explained by kin selection because the partners are not close relatives. Furthermore, mutualisms often involve animals, plants, fungi or microbes that probably do not have the cognitive abilities, such as memory and individual recognition, assumed by most game theoretical models. Why then are mutualisms common and integral parts of all natural communities? Are there general mechanisms promoting cooperation, and what are some of the specific forces breaking it down? The combined workshop and symposium addressed these questions, and presentations were made by a diverse group of empiricists, theoretical biologists and economists who study the evolution of multi-species cooperation in a variety of systems. It was an ideal forum in which to discuss similarities and differences informative to all groups.

- **Workshop 'Evolution of Cooperation Models and Theories'**
  15-18 September 2009, Laxenburg, Austria

With many contributions positioned right at the cutting edge of model-based cooperation research, this conference documented (and, in a small way, contributed to) an ongoing scientific transformation of the field. The conference itself served two primary functions. First, it brought together a particularly strong group of international research leaders engaged in modelling the evolution of cooperation in an international event of high visibility.

Second, the conference provided many TECT project leaders and other TECT scientists with an opportunity for meeting, discussing and showcasing their TECT-supported research. It thus helped them



The poster for the conference in Laxenburg, reproduced with permission from the International Institute for Applied Systems Analysis (IIASA).

to communicate the achievements of TECT among the leading scientists in the field, and enabled the latter to provide critical feedback. Among TECT participants, the conference was informally hailed as "one of the best conferences they ever attended" and as "one of the most important events that TECT helped catalyse."

- **Summer School 'Cooperators Since Life Began'**

  11-15 September 2010, Budapest, Hungary

This final TECT-INCORE school (which was originally slotted for April 2010 but had to be rescheduled due to the volcanic ash disruption) was organised as a sequel to the first such school, 'Tools of the Trade in Cooperation Research', which took place in Obernai, France in 2008. As with the first school, this event was primarily meant for PhD and post-doctoral students working in the TECT and INCORE programmes, as well as other students interested in the phenomenon of cooperation.

The objectives of the school were: (1) to survey recent results on, and approaches to, cooperation research at various levels of biological and social organisation; (2) to orient students to open problems in the respective fields; (3) to establish 'forward looks'; and (4) to foster further collaboration among the participants.

Professor Szathmáry teaching at the Budapest summer school.

- **Final conference**

  1-17 September 2010, hosted by Collegium Budapest (Institute for Advanced Studies)

The TECT Final Conference was constructed around five thematic sessions, corresponding to the five collaborative research projects funded within the TECT programme.

Collaborative research projects under TECT are united around one main goal, namely to highlight the evolutionary continuity of cooperation, both genetic and cultural, and to make this continuity an object of study in its own right: What explains the evolution of different mechanisms and strategies? Can we trace the evolutionary history of cooperative mechanisms and does this explain the forms of cooperation we observe today? Can 'bounded rationality' and the break-down of cooperation in modern human societies be explained by the activation of mechanisms that evolved in past environments? Does evolutionary history repeat itself in the form of a cultural evolution of human trading behaviour? The goal of the final conference was to bring TECT project members together for one last time, as a way of offering a final analysis of these central research questions in the same air of international, cross-discipline cooperation that has characterised the programme from the start.

Cooperation of CRPs for TECT Networking Activities

Keeping with the general theme of TECT, the following graphic displays the levels of cooperation that existed during the various networking events. The idea of cooperation is taken here in its widest sense, so CRP members do not necessarily need to have helped organise the events in question, but to have simply attended said event, in order to qualify as having cooperated.

Table 1. Cooperation of CRPs for TECT Networking Activities

BIOCONTRACT	COCOR	DYNCOOPNET	SENSE	SOCCOP
	Launch Conference: 4-7 July 2007, Collegium Budapest, Institute for Advanced Study, Hungary			
		Workshop: 'Studying Challenges of the Global Commons: connecting researchers with complementary interests' 5-7 September 2007, Stockholm, Sweden		
	Workshop: 'Towards a Unifying Theory of Cooperation and Mutualism' 8-11 January 2008, Oeiras, Portugal			
			Workshop: 'Trust, Reputation, Defectors and Sustaining Social Norms: studying spatially complex relationships in ways that connect TECT projects' 26-29 March 2008, Porto, Portugal	
Workshop 'The Social and Psychological Dynamics of Cooperation and Punishment' 25-27 April 2008, Barcelona, Spain		**Workshop 'The Social and Psychological Dynamics of Cooperation and Punishment'** 25-27 April 2008, Barcelona, Spain		**Workshop 'The Social and Psychological Dynamics of Cooperation and Punishment'** 25-27 April 2008, Barcelona, Spain
	Summer School: 'Tools of the Trade in Cooperation Research' 30 August – 6 September 2008, Obernai, France			


SOCCOP
SENSE
DYNCOOPNET
COCOR
BIOCONTRACT
Workshop: 'Visualisation and Space-Time Representation of Dynamic,Nonlinear, Spatial Data in DynCoopNet and Other TECT Projects' 25-26 September 2008, Madrid, Spain
Strategic Symposium: 'Money, Altruism and Genes: Exploring the Genetic Basis of Cooperative and Commercial Behaviours' including the workshop **'Genetic Basis of Coalition Formation in Nonhuman Primates'** and in conjunction with **TECT Scientific Committee Meeting** (22 November) and **TECT General Meeting** (22-23 November)
20-23 November 2008, Barcelona, Spain
Workshop 'Mutualism: Plants and the Evolution of Cooperation and Trading' 7-9 May 2009, Harvard University, Cambridge, USA
Workshop 'Mutualism: Plants and the Evolution of Cooperation and Trading' 7-9 May 2009, Harvard University, Cambridge, USA
Workshop 'Evolution of Cooperation Models and Theories'
15-18 September 2009, Laxenburg, Austria
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Summer School 'Cooperators Since Life Began'
11-15 September 2010,
Budapest, Hungary
Summer School 'Cooperators Since Life Began'
11-15 September 2010, Budapest, Hungary
Final Conference 15-17 September 2010, hosted by Collegium Budapest (Institute for Advanced Studies), Hungary

3.4 **Publications**

A comprehensive list of all publications and dissemination activities which resulted from the TECT research project can be found at: http://www.esf.org/activities/eurocores/running-programmes/tect/publications.html. We also offer below a selection of publications per CRP which provides a taste of the high level of scientific output from the programme:

Title of CRP:

Cooperation in Mutualisms: contracts, markets, space and dispersal (BIOCONTRACT)

1. ARCHETTI, M., ÚBEDA, F., FUDENBERG, D., GREEN, J., PIERCE, N.E. and YU, D.W. (2011)
Let the right one in: a microeconomic approach to partner choice in mutualisms. *The American Naturalist* 177, 75-85.

2. NAKAMARU, M. and DIECKMANN, U. (2009)
Runaway selection for cooperation and strict-and-severe punishment. *Journal of Theoretical Biology* 257, 1-8.

3. SZILÁGYI, A., SCHEURING, I., ORIVEL, J., EDWARDS, D.P. and YU, D.W. (2009)
The evolution of intermediate castration virulence and ant coexistence in a spatially structured environment. *Ecology Letters* 12, 1306-1316.

4. TRINDADE, S., SOUSA, A., XAVIER, K., DIONISIO, F., FERREIRA, M.G. and GORDO, I. (2009)
Positive epistasis drives the acquisition of multidrug resistance. *PLoS Genetics* 5(7): e1000578. doi: 10.1371/ journal.pgen.1000578.

5. WEYL, E.G., FREDERICKSON, M.E., YU, D.W. and PIERCE, N.E. (2010)
Economic contract theory tests models of mutualism. *Proceedings of the National Academy of Science USA* 107, 15712-15716.

Title of CRP:

Cooperation in Corvids (COCOR)

1. BAGLIONE, V., CANESTRARI, D., CHIARATI, E., VERA, R. and MARCOS, J.M. (2010)
Lazy group members are substitute helpers in carrion crows. *Proceedings of the Royal Society of London* B 277, 3275-3282.

2. FRASER, O.N. and BUGNYAR, T. (2010)
Do ravens show consolation? Responses to distressed other. *PLoS One* 5, e10605.

3. MIGLINO, O., PONTICORVO, M., DONETTO, D., NOLFI, S. and ZUCCA, P. (2008)
Cooperation in corvids: a simulative study with evolved robot. In: R. Serra, M. Villani, I. Poli (eds.), *Artificial Life and Evolutionary Computation*, 179-188, World Scientific Computing.

4. SCHEID, C. and NOË, R. (2010)
The performance of rooks in a cooperative task depends on their temperament. *Animal Cognition* 13, 545-553.

5. SERRA-GARCIA, M., VAN DAMME, E. and POTTERS, J. (2010)
Hiding an inconvenient truth: lies and vagueness. TILEC Discussion Paper No. 2010-029. Available at SSRN: http://ssrn.com/abstract=1653734; forthcoming in *Games and Economic Behavior.*

Title of CRP:

Dynamic Complexity of Cooperation-Based Self-Organising Networks in the First Global Age (DynCoopNet)

1. CRESPO SOLANA, A. (2010)
Crespo DynCoopNet DATA Collections DATABASE, Digital Repository CSIC.
URL: http://digital.csic.es/handle/10261/28394

2. CRESPO SOLANA, A. *and* ALONSO GARCÍA, D. (eds.) *Merchant Networks in the First Global Age. Cooperation and Representation*,
(under preparation) forthcoming, 2011/2012.
Collective volume with articles from: Jack Owens, Javier Quinteros, David Alonso, Amélia Polonia, Amandio Barrios, Sean T. Perronne, Rila Mukherjee, Tijl Vanneste, Sara Pinto, Adolfo Urrutia Zambrana, María José García Rodríguez, Miguel A. Bernabé Poveda, Marta Guerrero Nieto, Esther Pérez, Isabel del Bosque, Roberto Maestre, Juan Manuel Sanchez-Crespo Camacho, Ana Sofía Ribeiro, Werner Scheltjens, Antoni Picazo Muntaner, Monica Wachowicz, W. Siabato, M.A. Bernabé-Poveda and A. Fernández-Wyttenbach.

3. MUKHERJEE, R. (ed.) (2011)
Networks in the First Global Age 1400-1800,
New Delhi, Primus Books. Collective volume with articles from: Amândio Barros, Ernestine Carreira, David Alonso García, R.L. Hangloo, Srijan Sandip Mandal, Rila Mukherjee, Antoni Picazo Muntaner, J.B. Owens, Amelia Polonia, Ana Crespo Solana, Alex M. Thomas and Timothy D. Walker. ISSBN: 978-93-80607-09-2.

4. KRIZ, K., CARTWRIGHT, W. AND HURNI, L. (eds.) (2010) *Mapping Different Geographies*. Springer Verlag, Heidelberg, pp. 105-127. ISBN: 978-3-642-15536-9. DOI: 10.1007/978-3-642-15537-6. With articles from: Amélia Polónia, Miguel Nogueira, Amândio Barros, Teresa Iturrioz, Monica Wachowicz, Alberto Fernández-Wyttenbach, Miguel Angel Bernabé Poveda, William Siabato.

5. OWENS, J.B. (2007)
Toward a geographically-integrated, connected world history: Employing geographic information systems (GIS). *History Compass* 5, 6 (October): 2014-2040. doi: 10.1111/j.1478-0542.2007.00476.x

6. PICAZO MUNTANER, A. (2010)
Comercio y Colaboración en la Primera Edad Global, 1400-1800, vols I & II: vol. 1. Compañías mercantilistas en el Indopacífico, and vol. II. Redes y colaboración en Manila. El modelo hispánico Cooperjald Ld, London, free E-Book. http://www.ideaindia.com/product_detail.php?pid=1860

Title of CRP:

Sustaining Eco-economic Norms for a Sustainable Environment (SENSE)

1. CROFOOT, M.C., RUBENSTEIN, D.I., MAIYA, A.S. and BERGER-WOLF, T.Y. (2011)
Aggression, grooming and group-level cooperation in white-faced Capuchins (*Cebus capucinus*): insights from social networks. *American Journal of Primatology*, forthcoming.

2. HOEL, M. and DE ZEEUW, A. (2010)
Can a focus on breakthrough technologies improve the performance of international environmental agreements? *Environmental & Resource Economics* 47,3, 395-406.

3. HOMMES, C.H. and OCHEA, M.I.
Multiple steady states, limit cycles and chaotic motion in evolutionary games with logit dynamics. Under submission.

4. NADELL, C.D., XAVIER, J.B., LEVIN, S.A., FOSTER, K.R. (2008)
The evolution of quorum sensing in bacterial biofilms. *PLoS Biol* 6(1): e14. doi:10.1371/journal.pbio.0060014.

5. SIGMUND, K., DE SILVA, H., HAUERT, C. and TRAULSEN, A. (2010)
Social learning promotes institutions for governing the commons. *Nature* 466, 861-863.

6. SIGMUND, K.,HAUERT, C., TRAULSEN, A., NOWAK, M.A. and BRANDT, H. (2007)
Via freedom to coercion: the emergence of costly punishment. *Science* 316, 1905-1907.

Title of CRP:

The Social and Mental Dynamics of Cooperation (SOCCOP)

1. BICKERTON, D. and SZATHMÁRY, E. (eds) (2009)
Biological Foundations and Origin of Syntax. MIT Press, Cambridge, MA.

2. CASTELFRANCHI, C. and FALCONE, R. (2010)
Trust Theory: A Socio-Cognitive and Computational Model. Wiley & Sons, Chichester.

3. GINTIS, H. (2009)
The Bounds of Reason: Game Theory and the Unification of the Behavioral Sciences. Princeton University Press.

4. NAVARRO, A. (2009)
Genoeconomics: Promises and Caveats for a New Field. *Annals of the New York Academy of Science* 1167, 57-65.

4.
Final Evaluation

The purpose of the final evaluation is for a dedicated Review Panel of international experts (details of whom you will find on page 26), to assess the scientific cooperation and the interactions among the investigators, and to identify the achievements of the TECT programme and the lessons there are to be learned for potential follow-up initiatives.

The assessment was based on the scientific achievements highlighted by the project leaders as well as the usefulness and impact of the networking, training and dissemination activities undertaken during this period. To this end, investigators were asked to highlight the activities that proved most useful to each CRP, providing one example to illustrate each case. The balance between input and output indicated whether the CRPs made good, optimal or insufficient use of the TECT programme.

To limit the workload on the investigators' side, and to avoid overburdening Review Panel members, the progress report was limited to a maximum of four pages per CRP. The investigators were asked to provide concise and clear responses and no more than one example to illustrate each point. Only highlights of the activities undertaken by each CRP were reported, avoiding duplication of information already available at ESF.

The TECT office at ESF prepared a list of all the networking, training and dissemination activities undertaken during the reporting period, including the programme and the scientific report of each event. This material was featured in a restricted access website which was made available to the Review Panel and the TECT Management Committee as supporting documentation.

On the basis of the CRP reports and the supporting material provided by the office, Review Panel members were asked to provide an objective assessment of the achievements of the TECT programme. These individual assessments then formed the bases of discussion for the Final Review Panel meeting, which was held in Brussels. The outcome of this meeting was a consensus statement which is included below, a document which provides a collective, objective assessment of the achievements of the TECT programme, identifying strengths and weaknesses and making recommendations for potential follow-up initiatives.

Consensus Statement for TECT

Prolegomena

The Panel would like to note from the outset that there are some difficulties of a general nature in evaluating a programme like TECT. These difficulties arise from the inherent paradox of the EUROCORES programmes, and affect the ability of the Panel to judge the questions relating to research highlights and to the realised potential of TECT. On the one hand, EUROCORES programmes are tasked with forging bridges between different disciplines, with creating novel, interdisciplinary approaches to pivotal scientific questions. The Panel agrees that this has certainly been the case with TECT. Yet this endeavour is long-term and cannot be fully contained within, nor fully evaluated from, the three-year duration of the current programme. The Panel understands that the idea of extending the duration of EUROCORES programmes has been mooted in the past, and that this duration will not realistically be extended within the foreseeable future. Given this, the Panel recommends that future EUROCORES programmes are reviewed at a later stage when cooperation has matured and

its results are more clearly visible. Also, the ambitious goals of future programmes could perhaps be streamlined and more closely focused, so as to better fit the three-year time-span, if indeed this is to be maintained. It is with these issues in mind that the Panel makes its assessment.

Research Highlights

The EUROCORES programme *The Evolution of Cooperation and Trading* (TECT) has been a very ambitious and worthwhile undertaking. Cooperation is omnipresent in the biological and social sciences, as well as beyond. The TECT programme was launched to provide researchers with an opportunity to conduct innovative, cross-disciplinary research using, and aiming at, new methods and technologies.

In their Final Evaluation, the Review Panel found that all collaborative research projects (CRPs) have benefited from the opportunities to meet and interact offered by the TECT programme. In this respect, DynCoopNet stands out: this wide-ranging collaboration of historians, geographers and economists has already built bridges with disciplines from other subject areas, most notably with the geneticists from the SOCCOP CRP, and has created a dataset with far-reaching potential. They had both a lot to offer and a lot to gain from their embedding in the programme, highlighting the significant impact of GIS research.

In general, the TECT programme enhanced the interactions between different fields on important issues, exposing young researchers to approaches other than those of their own disciplines or their home departments. In doing so, the research projects funded within the TECT programme have laid the groundwork for continued exploration and development in this direction. Interactions such as those between economists and biologists in BIOCONTRACT, or between biologists and researchers in robotics in COCOR, have opened up interesting levels of dialogue, whose exchanges have already borne innovative fruit. From the perspective of the TECT programme, though, the Panel felt that more communication and interaction at a cross-CRP level, as opposed to an intra-CRP level, could have brought about an even greater pollination of interdisciplinary ideas. Nevertheless, the Panel recognises that the CRPs have made serious, concerted inroads towards accomplishing the programme's main goals.

TECT facilitated a large amount of research activity in terms of publications and the Panel is convinced that the high levels of scientific quality within the individual projects would not easily have come about without these projects' involvement in TECT. All of the CRPs have produced high-level publications in their collaborative fields, indicating a wide impact in the scientific community.

Networking, Training, Dissemination

The levels of networking, quality of training and extent of dissemination have been the highlights of TECT. Numerous joint conferences and workshops, of interest to at least two but sometimes all CRPs, were organised during the running-time of the programme. Most notable in this regard was the workshop in Laxenburg which, although theoretical in approach, was nevertheless hailed by numerous CRPs, including many from practice-based projects, as being highly beneficial for their own research. The Panel expects that these activities will have a lasting impact on the PhD students and post-docs especially – opening up possibilities of cross-fertilisation by means of new problems and ideas from disciplines that they would not otherwise have been exposed to. The extra funding for cross-CRP activities – in addition to the individual projects' research grants – undoubtedly facilitated this process.

The Panel especially notes the importance of TECT's cross-CRP summer schools for providing students with opportunities to share in the theoretical and methodological bases of other disciplines. Most importantly, these summer schools fostered cross-disciplinary dialogue. Finding a 'common language' between disciplines is often fraught with difficulties, and the TECT summer schools were designed to go some way to remedying this situation for a new generation of scholars.

In terms of dissemination, the Panel notes the importance of utilising the internet for enabling the scientific community easy access to one's research results. Websites are an important tool to use for this purpose and should be encouraged for all projects. In this regard, the Panel recommends a harmonised approach, for example via the ESF website.

Realisable Potential

The final reports show that the TECT programme members have made good use of the TECT programme and the various networking activities have contributed favourably to the research outputs of the participants. A number of important networks have been built by TECT participants and the Panel recommends that this momentum is sustained by further funding initiatives.

TECT was an ambitious programme, one which attempted to create new, cutting-edge synergies

between subjects and scientists, who and which were sometimes far apart. Given the scale of the task involved in this endeavour, the full potential of TECT could not be expected to be seen in the three-year duration of the programme, but will instead require future efforts from the programme's participants. This should be seen as a positive reflection on TECT, one which understands the complexities involved in such a multinational, interdisciplinary programme, but yet acknowledges the significant steps already made by the cooperating partners.

Recommendations for Future Initiatives

The Panel notes the difficulties encountered by a number of the CRPs in terms of receiving funding committed by national funding agencies and understands the frustration this has caused. Although the Panel is happy to note that measures have been taken to remedy these issues for future initiatives, it should nevertheless be noted that, for TECT at least, these problems had a palpable effect. On a positive note, the Panel wishes to point to the commendable example laid by most of the participating funding organisations, who adhered to the EUROCORES protocols to the letter. It is hoped that their example is followed by all funding agencies involved in future EUROCORES programmes.

It is the recommendation of the Panel that future evaluations take place approximately one year after the formal end of the networking and dissemination phase of the programme. This extra time would allow future panels to get an improved idea of what the programme has accomplished, thereby gaining a fuller perspective on the programme they are evaluating. Also, future panel members should be invited to some of the cross-CRP events – in particular the final conference – so as to get a better, more nuanced picture of the projects themselves.

In terms of dissemination outcomes, the Panel found it unhelpful that the reports provided long lists of publications which were attributed to TECT, notwithstanding the explicit instructions of the reporting form only to include those publications which originated to a significant extent from work undertaken in the framework of the TECT programme. Although the Panel certainly acknowledges the difficulties involved in gauging the various degrees of publication relevance, it nevertheless encourages the ESF, in coordination with Member Organisations, to create such measurement norms and implement them in future reporting.

Overall, the Panel feels justified in concluding that the TECT programme enabled world-class researchers to meet and share ideas on the theme of 'cooperation', resulting in some truly innovative collaborations. A final recommendation of the Panel would be for the Project Leaders to produce a collaborative publication to which all of the CRPs would contribute. This recommendation reflects the Panel's earlier stated wish that the networks initiated by TECT are sustained both intellectually (by researchers continuing to collaborate) and financially (by securing further funding) in the future.

5. Governing Bodies

The quality of the EUROCORES Programme TECT was ensured by the following committees:

5.1 TECT Scientific Committee

The Scientific Committee – including the Project Leaders and co-Project Leaders of the TECT Collaborative Research Projects and the EUROCORES Programme Coordinator – was responsible for the networking and dissemination of activities in the programme. At its first meeting the Scientific Committee appointed Professor Ronald Noë as its Chair.

(In alphabetical order)

Dr Ana Crespo Solana
Centro de Ciencias Humanas y Sociales, Consejo Superior de Investigaciones Científicas, Madrid, Spain

Professor Ulf Dieckmann
Evolution and Ecology Program, International Institute for Applied Systems Analysis (IIASA), Laxenburg, Austria

Professor Raghavendra Gadagkar
Centre for Ecological Sciences, Indian Institute of Science, Bangalore, India

Professor Herbert Gintis
Department of Economics, Central European University (CEU), Budapest, Hungary

Professor Peter Hammerstein
Innovationskolleg Theoretische Biologie, Humboldt-Universität zu Berlin, Germany

Dr Rüdiger Klein
(Secretary until May 2008)
European Science Foundation, Strasbourg, France

Professor Simon A. Levin
Department of Ecology and Evolutionary Biology, Princeton University, USA

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(Secretary from May 2008 to April 2010)
European Science Foundation, Strasbourg, France

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Professor Daniel Rubenstein
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Professor Karl Sigmund
Department of Mathematics, University of Vienna, Austria

Professor Eörs Szathmáry
Institute for Advanced Study, Collegium Budapest, Hungary

5.2 TECT Review Panel

The independent international Review Panel, formed of leading experts in the field, oversaw the scientific aspects of the programme. The Review Panel played a key role in the selection and review process.

(In alphabetical order)

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Department of Mathematics, Wilfrid Laurier University, Waterloo, Canada

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Professor Catherine Eckel
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Professor Raghavendra Gadagkar
Centre for Ecological Sciences, Indian Institute of Science, Bangalore, India

Professor Bengt Hansson
Department of Philosophy, Lund University, Sweden

Dr Agnar Helgason
Department of Anthropology, University of Iceland, Reykjavik, Iceland

Professor Barbara Hellriegel
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Dr Robert Hoffmann
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Professor Marcelle Holsters
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Professor Melinda J. Laituri
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Professor Jean-Pierre Nadal
(from September 2006)
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Professor Gábor Vida
Hungarian Academy of Sciences, Institute of Ecology and Botany, Vacratot, Hungary

Professor Roberto Zoboli
CERIS-CNR, Milano, Italy

5.3 TECT Management Committee

The programme was overseen by the Management Committee, formed by one representative of each of the participating National Funding Agencies and the EUROCORES Programme Coordinator.

(In alphabetical order)

Austria

FWF
Der Wissenschaftsfonds.

Dr Falk J. Reckling
Fonds zur Förderung der wissenschaftlichen Forschung (FWF) – Austrian Science Fund, Abteilung für Geistes- u. Sozialwissenschaften, Wien

France

cnrs

Professor Michel Salzet
Université des Sciences et Technologies de Lille, Laboratoire de Neuroimmunologie des Annélides, Villeneuve d'Asq

Hungary

OTKA

Dr Gábor Toth
Bioinformatics Group, Agricultural Biotechnology Center, Gödöllo

Italy

Consiglio Nazionale delle Ricerche

Dr Antonella Briuglia
Consiglio Nazionale delle Ricerche (CNR), Department for International Activities, Rome

The Netherlands

NWO
Netherlands Organisation for Scientific Research

Mr Berry J. Bonenkamp
Netherlands Organisation for Scientific Research, Social Sciences, The Hague

Portugal

FCT
Fundação para a Ciência e a Tecnologia

Dr Maria Corte-Real
Fundacao para a Ciencia e Tecnologia (FCT), Lisboa

Spain

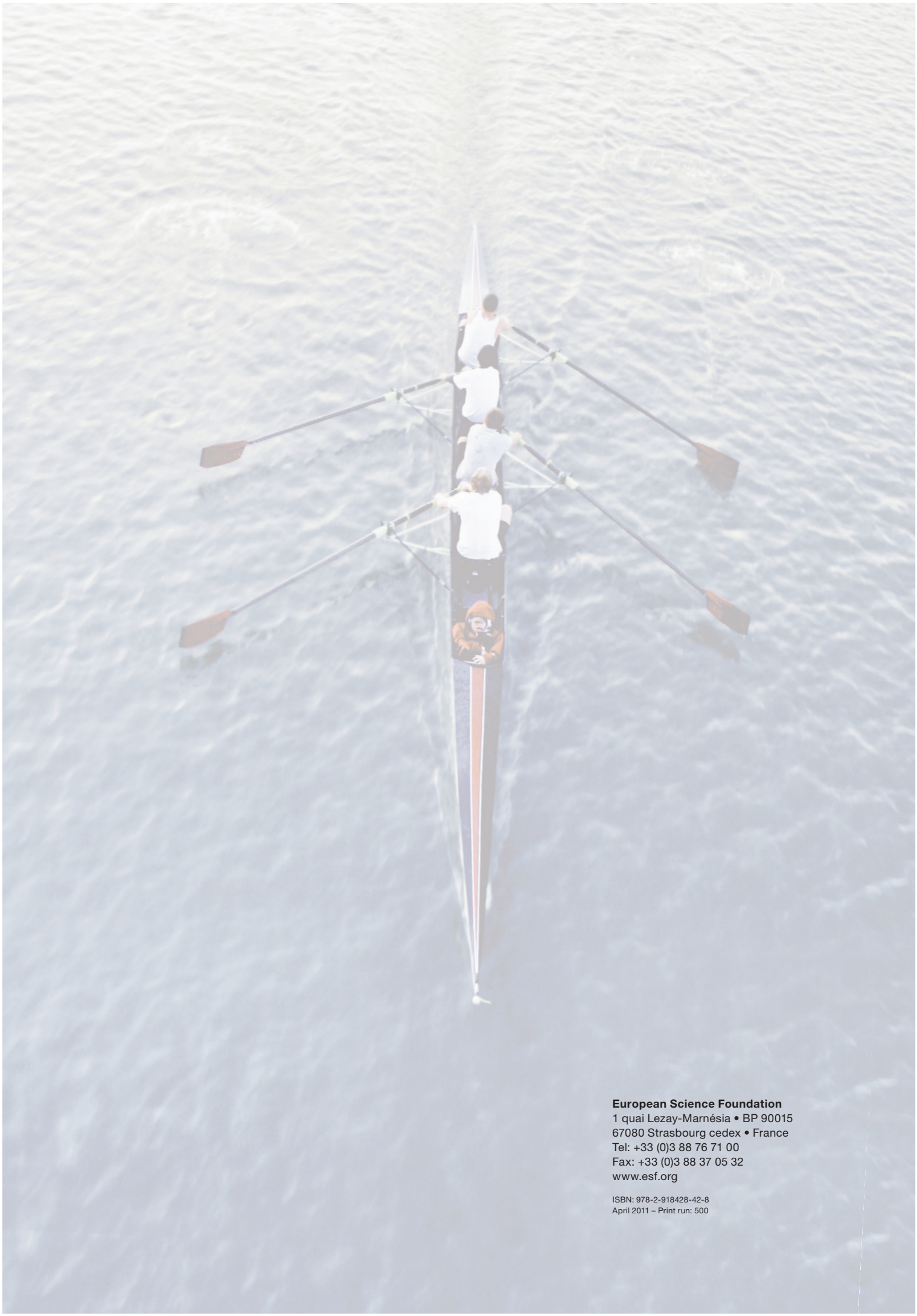
MINISTERIO DE EDUCACIÓN Y CIENCIA

Professor Aníbal González
Comisión Interministerial de Ciencia y Tecnología (CICYT), Madrid

United States

NSF

Dr Julia Lane
National Science Foundation (NSF), Directorate for Social, Behavioral & Economic Sciences, Arlington



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