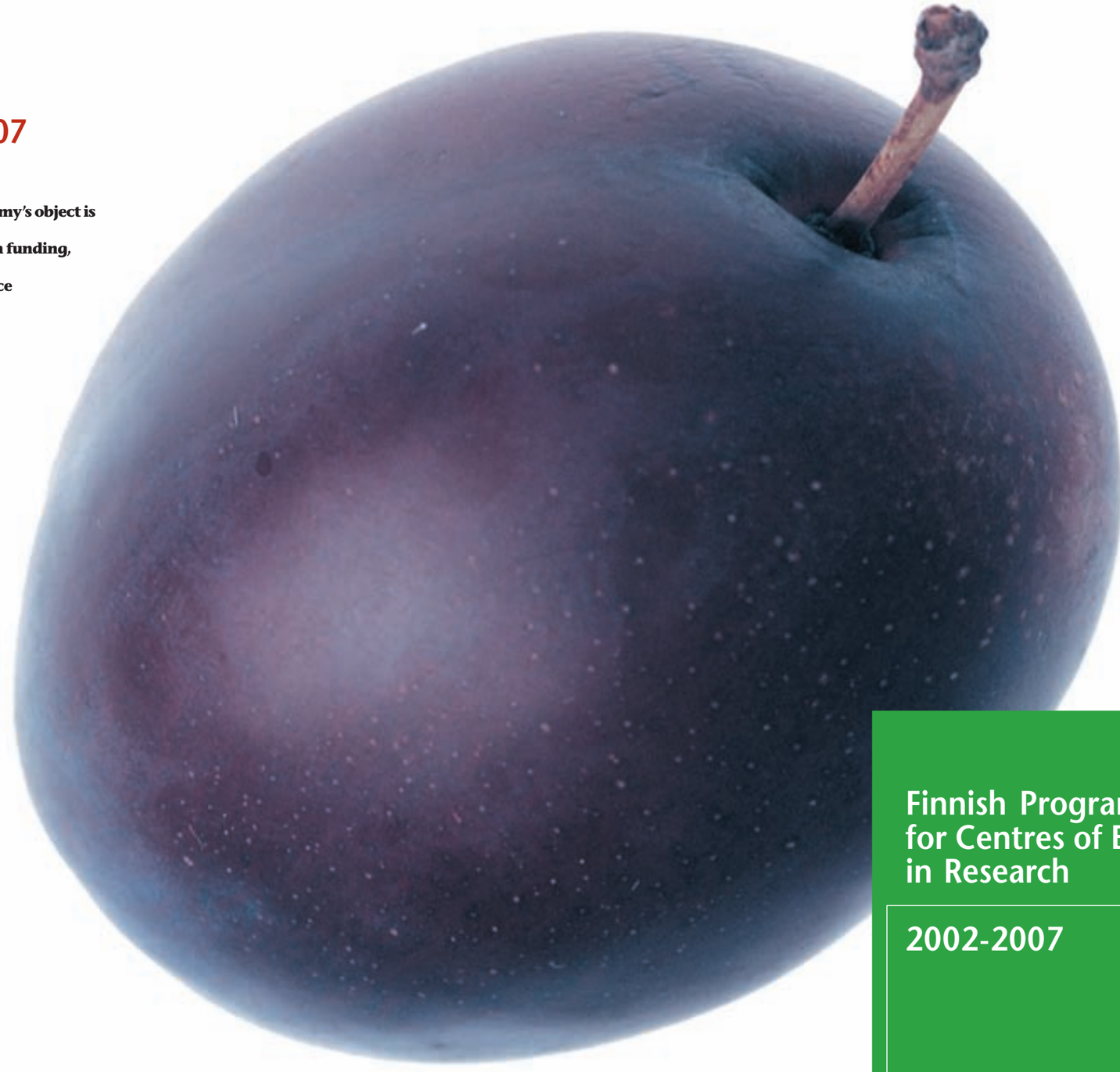
Finnish Programme for Centres of Excellence in Research 2002-2007

The Academy of Finland is an expert organisation on research funding. The Academy's object is to promote high-level scientific research through long-term quality-based research funding, science and science policy expertise, and efforts to strengthen the position of science and scientific research.

The main accent in the Academy's science policy is on improving the career opportunities of professional researchers, and women and young researchers in particular; on developing high-quality research environments; and on making the best possible use of global opportunities for cooperation in all areas of research, research funding and science policy.

The Finnish Programme for Centres of Excellence in Research is one of the key instruments in the Academy's effort to develop creative research environments. This brochure describes how the Academy of Finland has implemented the national strategy for centres of excellence in research and briefly introduces the 16 centres of excellence nominated for the six-year period 2002-2007.

The units elected for the 2000-2005 centre of excellence programme have been introduced in a separate brochure. Information on the Academy of Finland and on other forms of research funding available through the Academy is provided on the Academy's web site at www.aka.fi/eng



Finnish Programme for Centres of Excellence in Research

2002-2007

ACADEMY OF FINLAND

Vilhonvuorenkatu 6, POB 99, FIN-00501 Helsinki, Finland
Phone +358 9 774 881 Fax +358 7748 8299 Web site www.aka/eng E-mail viestinta@aka.fi

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Academy of Finland Communications
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Developing creative research environments is a long-term effort

Finland launched in the 1990s a systematic effort to develop creative, internationally competitive research and training environments. In terms of science and funding policy the most important instruments in this effort are the centre of excellence programmes as well as separate research programmes.

The first 12 centres of excellence in research were appointed for 1995-1999, and a further five units were awarded centre of excellence status for 1997-1999.

The publication in 1997 of a National Strategy for Centres of Excellence in Research (Publications of the Academy of Finland 6/97) provided a clearer profile and direction for the Finnish centre of excellence policy. At the same time the policy was integrated as part of the country's research, education and technology policy.

In general terms the centre of excellence policy is aimed at raising the level and quality in Finnish science and at improving its international competitiveness, visibility, and esteem. The centre of excellence strategy is designed to support all disciplines from the natural sciences and engineering to the humanities and social sciences. Another key objective is to promote interdisciplinary research.

Two six-year centre of excellence programmes have been launched on the strength of this strategy. A total of 26 units are included in the 2000-2005 programme, the 2002-2007 programme involves 16 centres of excellence.

Administration and coordination of the centre of excellence programmes rests with the Academy of Finland, which is working closely particularly with the National Technology Agency (Tekes). The Academy will be following the work of all centres of excellence, taking note of the experiences gained and the latest international developments in its efforts to further develop and improve its centre of excellence policy.

What is a centre of excellence and how are the units selected?

Size doesn't matter in the selection of centres of excellence; the key criteria are the scientific quality of their work, the creativity of their research environments and their ability to inspire new scientific breakthroughs. A centre of excellence should be at the cutting edge of international research in its field of research, or at least close enough to reach the international forefront during its six-year term. The unit must have a clear set of common objectives for its research as well as a common management.

Selection takes place in an open competition. Peer reviews are used to assess each proposed CoE against the best international research in that particular field. Centres working in different fields are not directly compared to one another. The primary evaluation criteria are the scientific merits of the head of the proposed centre of excellence and other senior researchers, the proposed CoE's research and action plan, its research environment, and researcher training.

The application process is carried out in two phases. In the first phase applicants submit brief plans of intent, which are reviewed by experts in Finland. Applicants going through to the second phase will be asked to prepare full applications, which are reviewed by foreign experts. Experts will personally visit all the proposed CoEs on which they are to submit an assessment.

Multidisciplinary and well-networked units prominent among new centres of excellence

A total of 105 units submitted applications for the 2002-2007 centre of excellence programme, and 30 went through to the second stage. Out of these shortlisted units 16 were eventually selected to take part in the programme. More than half of them include research teams from more than one university or research institute.

The number of CoEs that are involved in different kinds of networks and that take a multi-disciplinary approach, is greater than in the centre of excellence programme for 2000-2005.

Contract-based operation

Contracts have been drawn up with each centre of excellence to set out the responsibilities and resources of each centre, its host organisation (or organisations) and the funding bodies (the Academy of Finland, the National Technology Agency, any other outside funding bodies). The contract covers the first three years of the programme; the parties will meet again in three years' time to negotiate on the continuation of the contract for the next three-year period.

Scientific advisory boards consisting of top international experts will be appointed to each centre of excellence to support and monitor its operation. The scientific advisory board may make initiatives with a view to further improving the impact and efficiency of the centre's operation and suggest new research questions and methods. The host organisations and funding bodies will attend the advisory board's meetings as observers.

At the end of the six-year period an international review will be commissioned to assess the performance of each centre of excellence and the programme as a whole.

Several funding bodies involved

During the funding period of the programme the Academy of Finland in spending around EUR 33.1 million and the National Technology Agency around EUR 5.3 million to support the 16 centres of excellence. In addition, centres of excellence may apply for Academy research posts and re-

searcher training grants and take part in research programmes as well as apply for other funding from the National Technology Agency.

The host organisations (i.e. universities and research institutes) will be providing significant long-term support to their respective centres of excellence. Funding will also be received from private foundations and business companies.

Funding from the Academy of Finland for the two ongoing centre of excellence programmes represents around 8.5 per cent of the Academy's total annual research allocations.

National policy now an integral part of European and global centre of excellence policies

In recent years more and more countries have been adopting the centre of excellence concept as part of their science policies. The strategies applied to support scientific excellence vary from case to case, but the ultimate objectives are the same throughout (Publications of the Academy of Finland 2/01).

During the past couple of years it has become increasingly clear that national centre of excellence policies are an integral part of an international policy where different kinds of strengths can complement one another. The European Union's sixth framework programme for 2002-2007 provides a useful platform for the Finnish centres of excellence to network with the best expertise in other countries.

Units selected for Centre of Excellence Programme 2002-2007

Research Unit of Economic Structures and Growth

University of Helsinki
Headed by Professor Erkki Koskela

The Research Unit of Economic Structures and Growth (RUESG) consists of three teams.

Research in the Macrotheory, Game Theory and Applications team is focused on economic trends and expectations, economic openness and growth, economic development in Finland, incentive systems in business companies, business communication systems, the economy of immaterial property rights and the impacts of systems of financial intermediation.

The Taxation, Natural Resources and Financial Markets team is interested in labour taxation, environmental economy and taxation, the forest economy, labour mobility and the housing market and the structure of unemployment.

The Time Series Econometry team is concerned to study new methods of series analysis as well as the modelling of stock and currency exchange markets.

Each team is engaged in a large number of research projects, some of which cut across team boundaries or involve cooperation with outside researchers.

The CoE has a research staff of 24.

History of Mind Research Unit

University of Helsinki and University of Jyväskylä
Headed by Academy Professor Simo Knuuttila

The main focus of research at the History of Mind Research Unit is on theories of the structure and function of the human mind in Greek philosophy, medieval Arab and Latin philosophy and the philosophy of the Early Modern Age. Areas of special interest include conceptions of knowledge, comprehension and inference, self-consciousness, will and emotions as well as changes in the concepts and philosophical assumptions related to these themes.

Key issues concern the distinction between body and soul, abilities of the mind, concepts of subject and object of mental attitudes, the concept of normalcy in connection with the analysis of cognitive attitudes, as well as conceptions of the normalcy and abnormalcy of mental conditions and mental disorders.

Knowledge about the birth and development of concepts and conceptions related to the philosophy of the mind is an integral part of intellectual history, but it also helps us understand current philosophical problems.

The CoE has a research staff of 24.

Based at the universities of Helsinki and Jyväskylä, the History of Mind Research Unit is headed by Academy Professor Simo Knuuttila (left). He is joined here in the corridors of the University of Helsinki by Professor Lilli Alanen, Professor Risto Saarinen, Pauliina Remes, M.A., Professor Juha Sihvola and Martina Reuter, D.Phil.

Research Programme on Male Reproductive Health
University of Turku
Headed by Professor Ilpo Huhtaniemi

Research within the Male Reproductive Health programme is divided into four basic and clinical projects that all address the key challenges presented to andrology, or male reproductive health.

These projects are concerned with the mechanisms of the pituitary and testicular hormones that are involved in reproductive functions as well as with the role of environmental and hereditary factors in disorders of the male genitalia (e.g. cryptorchism) and in the lowered semen quality recently seen in many countries.

The projects also introduce new strategies for male contraception and explore the impacts of changes in hormonal function upon ageing men.

The CoE has a research staff of 51.

Finnish Research Unit on Mitochondrial Biogenesis and Disease (FinMIT)

University of Tampere and University of Helsinki
Headed by Professor Howard Jacobs

Research at FinMIT is aimed at gaining an understanding at the basic level of the mechanisms behind mitochondrial disorders. This information will be used in exploring the unknown biological mechanisms that in normal cells are involved in the maintenance of mitochondrial DNA and its expression.

Applying model organisms, the unit's object is to establish the mechanisms involved in mitochondrial deafness and to identify the nuclear genes that cause mitochondrial diseases. A further object is to identify normal cell components that are related to the maintenance of mtDNA in human cells and tissue and to establish the role of these mechanisms in normal tissue ageing and in degenerative diseases.

Furthermore FinMIT aims to understand the mechanisms of the Leigh syndrome and to develop supportive therapies for genetic metabolism disorders using a disease model.

The CoE has a research staff of 45.

Professor Ilpo Huhtaniemi (left), Academy Research Fellow Matti Poutanen and Docent Jorma Toppari are planning ahead for the Research Programme on Male Reproductive Health at the University of Turku.

Helsinki Brain Research Centre

University of Helsinki, Helsinki University of Technology, Helsinki and Uusimaa hospital district
Headed by Academy Professor Risto Näätänen

The Helsinki Brain Research Centre (HBRC) applies the latest methods of brain research to investigate the principles of cognitive brain function. HBRC serves as an umbrella for six research teams from two of the biggest universities and leading hospitals in the country.

The purpose of the centre's research is to explore the foundations of learning, memory, attentiveness, emotions and language in the brain.

The new information obtained on the function of the human brain and the work that is done at HBRC to develop new research methods provide a firm foundation for clinical applications in such areas as the diagnosis and rehabilitation of learning and development disorders in children and adults. The mapping of brain function also facilitates the planning of surgical operations and the rehabilitation of stroke and tumour patients.

The CoE has a research staff of 79.

Working at the University of Kuopio, Professor Seppo Ylä-Herttuala (left), Päivi Turunen, M.Sc., and Kalevi Pulkkanen, MD, are concerned in their research with cardiovascular diseases and type 2 diabetes.

Centre of Excellence for Research in Cardiovascular Diseases and Type 2 Diabetes

University of Kuopio
Headed by Professor
Seppo Ylä-Herttuala

The research unit is concerned to uncover the mechanisms that lie behind atherosclerosis, cardiovascular diseases, type 2 diabetes and the artery disease that occurs in diabetes and to develop new approaches to the treatment of these public health problems.

The research makes use of the latest methods of molecular biology, transgenic and knockout animal models as well as gene therapy. In addition, the aim is to locate new disease genes in carefully selected patient materials.

The CoE has a research staff of 86.

Centre for Environmental Health Risk Analysis

National Public Health Institute and University of Helsinki
Headed by Research Professor Juha Pekkanen

The centre's aim is to develop methods for better and more coherent risk analysis. It conducts risk assessments on the basis of ultrafine particles in urban air and dioxins in food, making comparisons of these two pollutants at each stage of the assessment.

The centre has received international recognition for its multidisciplinary approach in researching the mechanisms leading to risks as well as for its work to develop improved methods for the assessment of exposure to hazardous substances.

In addition, the centre conducts epidemiological research by employing improved indices of exposure and effects and develops risk analysis in line with the principles described.

The CoE has a research staff of 37.

Research Unit on Physics, Chemistry and Biology of Atmospheric Composition and Climate Change

University of Helsinki, University of Kuopio and the Finnish Meteorological Institute
Headed by Academy Professor Markku Kulmala

The research unit is concerned to study the development and growth of small particles (aerosol particles) as well as their physical and chemical properties. Small particles have proved to be a significant

The research team exploring the composition of the atmosphere and climate change involves researchers from the University of Helsinki, the University of Kuopio and the Finnish Meteorological Institute. The Hyytiälä field station at Juupajoki is one of the places where Michael Boy, Ph.D. (left), Tanja Suni, Ph.D., Professor Markku Kulmala, Docent Ullar Rannik and Ismo K. Koponen, Ph.D., conduct their measurements.

uncertainty factor in the prediction of climate change. In addition small particles have undisputed health effects.

The growth of particles is influenced by physical, chemical, meteorological and biological conditions. For instance in forests photosynthesis produces carbohydrates, which following chemical reactions in the atmosphere can influence the birth and growth of aerosol particles. Among others the impact of increased carbon dioxide on this process is an important area of study.

Research is conducted in both experimental and theoretical settings. The research unit's core facilities include three field research stations and well-appointed aerosol laboratories.

The CoE has a research staff of 90.

Centre of Population Genetic Analyses

University of Oulu and University of Helsinki
Headed by Professor Pekka Pamilo

The centre applies the methods of genetic research to study the history of populations. Genetic transformations and changes in the relative frequency of different types of gene and their links reflect evolutionary history. On the basis of these changes it is possible for instance to locate new disease genes, to trace the genetic background of multifactorial properties and to explore the evolution of these properties.

One of the centre's key objects is to develop and apply the analytical tools required in processing the materials produced by genetic research. In addition to more theoretically oriented analyses the centre is especially interested in the evolution of plant reproduction systems and in the location of genes.

The CoE has a research staff of 26.

Microbial Resources Programme

University of Helsinki
Headed by Academy Professor Kaarina Sivonen

The research unit is concerned to study naturally occurring microbes (bacteria, fungi) that produce bioactive substances for use in the processing of natural raw materials, as research reagents and as raw materials for medicines. The microbe production mechanisms are analysed so that the components of these 'machineries' can be applied in the production of useful materials and as components in the development of new materials.

In addition the research unit is interested in studying the occurrence of toxins and their producer-microbes in foodstuffs and production plants, in waterways, in fodder and in the soil. The unit is also working to develop diagnostic tools and methods that can help reduce and prevent human exposure to toxins.

The CoE has a research staff of 59.

Academy Professor Kaarina Sivonen is in charge of work at the University of Helsinki to explore new applications for naturally occurring microbes. Others involved in the work at the Viikki Biocenter Applied Microbiology Research Unit include Professor Mirja Salkinoja-Salonen (front right), Professor Per Saris and Professor Annele Hatakka.

Developmental Biology Research Program
University of Helsinki
Headed by Professor Irma Thesleff

The research programme is concerned with the mechanisms that control embryonic development in mammals. An area of special interest is intercellular communication at gene and molecule level, which governs the formation of all organs and tissues as well as the differentiation of cells.

The model animals used in the programme are mice. Cell and organ culture techniques have been developed for the analysis of embryonic tissues. The programme produces transgenic mice in which the functions of the signal molecules have been modified. Several different mouse lines are used as models for human diseases, particularly developmental disorders and cancer.

These animal models can be used to develop new methods for the prevention, diagnosis and treatment of diseases.

The CoE has a research staff of 48.

Formal Methods in Programming

Åbo Akademi University
Headed by Academy Professor Ralph-Johan Back

Based at Åbo Akademi University, the Formal Methods in Programming Unit is interested in studying computer programming methods and in developing computer supported programming tools. One of the unit's main objects is to develop exact mathematical methods (so-called formal methods) that can be used to make sure computer programs are correct and reliable by construction.

Formal methods are applied in research to different stages of the programming process, such as program definition, design and implementation as well as to checking program correctness. Formal methods have been widely applied in different programming tasks, such as designing distributed systems, programming parallel processors, designing VLSI circuits with programming technology and object-oriented system construction.

The CoE has a research staff of 31.

From Data to Knowledge

University of Helsinki and Helsinki University of Technology
Headed by Professor Esko Ukkonen

Research at the From Data to Knowledge Unit is concerned with the development of computer methods for the processing of large and complex data materials. These methods will help people to find useful information from the data they have discovered.

This is a multidisciplinary effort: the research teams working under the unit's umbrella combine know-how in the fields of efficient algorithms, statistical methods, database and machine learning techniques as well as application sciences. The key tools applied are combinatorial pattern matching and data mining. The combination of these two approaches represents an internationally unique feature.

The results have practical application in molecular biology and bioinformatics, process industry, datacommunications, ecology and language technology.

The CoE has a research staff of 58.

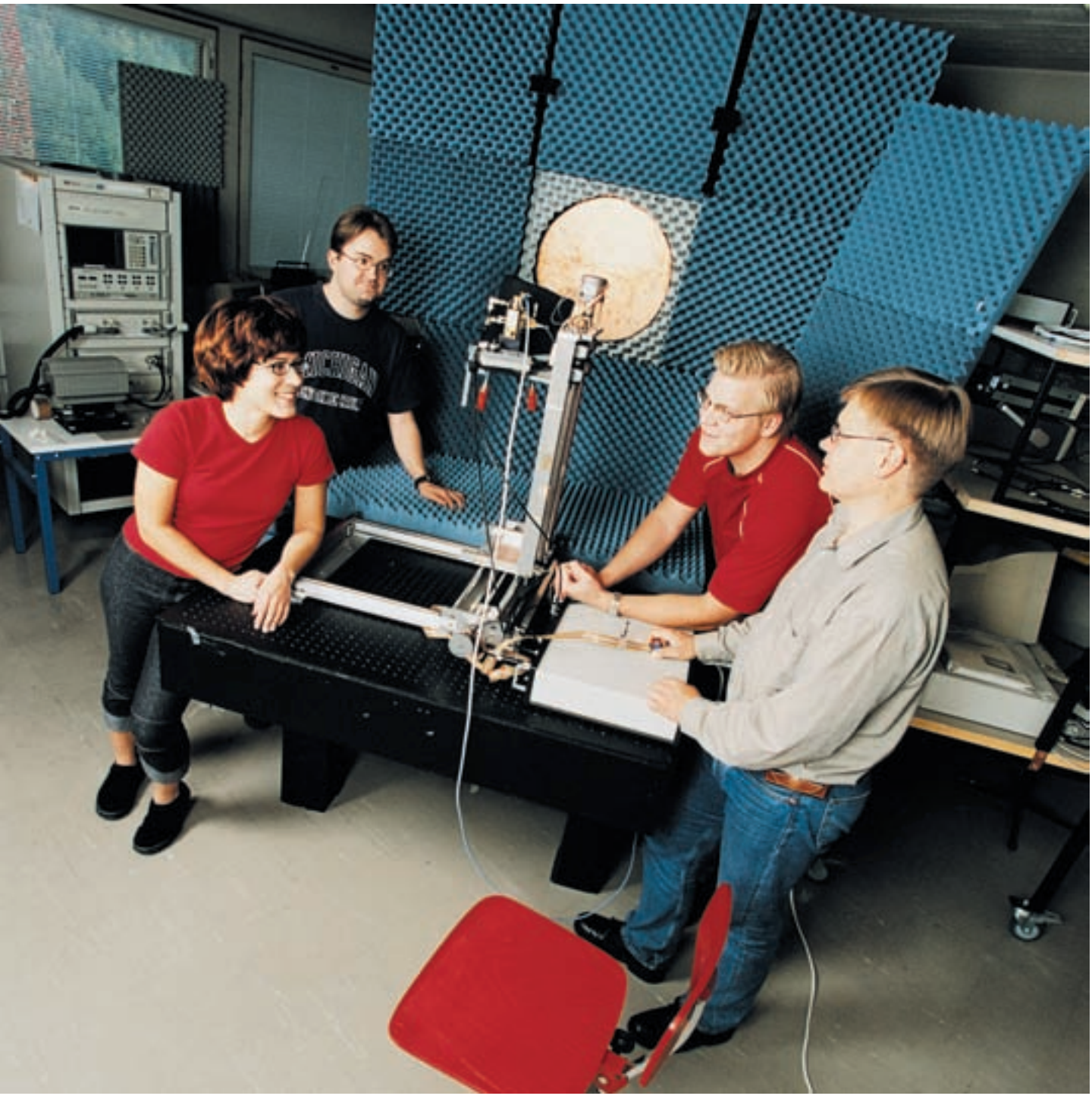
Smart and Novel Radios Research Unit

Helsinki University of Technology
Headed by Professor Antti Räisänen

The Smart and Novel Radios Research Unit (SMARAD) specialises in research on world-class RF, microwave and millimetre wave and datacommunications signal processing. Areas of special interest include RF techniques for wireless datacommunications, radio channel modelling and measurement, new and smart materials and structures, smart (adaptive) antennas, receiver structures and architectures and the signal processing algorithms they require.

The results will have practical application especially in future wireless communication systems. What is meant by 'smart' antennas or materials is their adaptability to RF signals or fields. In antenna measurement SMARAD is working on a novel method based on a radio hologram, which has already been successfully applied in testing the Odin satellite radio telescope.

The CoE has a research staff of 80.



Among the main areas of research at SMARAD are datacommunications signal processing and new methods of antenna measurement. Pictured here at the hologram CATR are Anne Lönnqvist, M.Sc. (left), Jussi Säily, Lic.Sc., Tomi Koskinen, M.Sc., and Janne Häkli, M.Sc.

Geometric Analysis and Mathematical Physics
University of Helsinki and University of Jyväskylä
Headed by Professor Pertti Mattila

The Research Unit of Geometric Analysis and Mathematical Physics integrates key areas of research in mathematical analysis and mathematical physics.

Analysis is one of the oldest areas of mathematics and remains one of the leading branches of pure mathematics. The methods of analysis are used in most mathematical applications.

During the past two decades mathematical physics has emerged as one of the most significant and respected branches of mathematics. The problems addressed are usually central to physics, and the methods applied are mathematical, most typically methods of mathematical analysis.

The CoE has a research staff of 60.

Bio- and Nanopolymers Research Group
Helsinki University of Technology, University of Helsinki and University of Turku
Headed by Professor Jukka Seppälä

The research group is concerned to study the synthesis of structurally controlled polymers by means of new polymer catalysis technology. The aim is to produce controlled nanoscale polymer structures and to use the polymers and composites thus obtained for purposes of releasing active substances and for tissue reinforcement.

Products that release bioactive molecules and/or the ions needed in the healing of hard tissues, have several medical and dental applications. Tissue engineering products can be used either to control the healing of tissues, or they may be used as extracellular matrices for growing tissue.

The CoE has a research staff of 73.

Contact information for centres of excellence 2002-2007

Research Unit of Economic Structures and Growth
Professor Erkki Koskela
Department of Economics
POB 17
FIN-00014 University of Helsinki
tel. +358 9 191 28757
fax +358 9 191 28736
erkki.koskela@helsinki.fi

History of Mind Research Unit
Academy Professor Simo Knuuttila
Department of Systematic Theology
POB 33
FIN-00014 University of Helsinki
tel. +358 9 191 23024
fax +358 9 191 23033
simo.knuuttila@helsinki.fi

Research Programme on Male Productive Health
Professor Ilpo Huhtaniemi
Department of Physiology
University of Turku
Kiinamyllynkatu 10
FIN-20520 Turku
tel. +358 2 333 7579
fax +358 2 250 2610
ilpo.huhtaniemi@imperial.ac.uk

Finnish Research Unit on Mitochondrial Biogenesis and Disease (FinMIT)
Professor Howard Jacobs
Institute of Medical Technology
FIN-33014 University of Tampere
tel. +358 3 215 7731
fax +358 3 215 7710
howard.t.jacobs@uta.fi

Helsinki Brain Research Centre
Academy Professor Risto Näätänen
Cognitive Brain Research Unit
Department of Psychology
POB 9
FIN-00014 University of Helsinki
tel. +358 9 191 23445
fax +358 9 191 22924
risto.naatanen@helsinki.fi

Centre of Excellence for Research in Cardiovascular Diseases and Type 2 Diabetes
Professor Seppo Ylä-Herttuala
A.I.Virtanen Institute for Molecular sciences
University of Kuopio
POB 1627
FIN-70211 Kuopio
tel. +358 17 163 075
fax +358 17 163 751
seppo.ylaherttuala@uku.fi

Centre for Environmental Health Risk Analysis
Research Professor Juha Pekkanen
Department of Environmental Health
National Public Health Institute
POB 95
FIN-70701 Kuopio
tel. +358 17 201 368
fax +358 17 201 265
juha.pekkanen@ktl.fi

Research Unit on Physics, Chemistry and Biology of Atmospheric Composition and Climate Change
Academy Professor Markku Kulmala
Division of Atmos pheric sciences
Department of Physical Sciences
POB 64
FIN-00014 University of Helsinki
tel. +358 9 191 50756
fax +358 9 191 50717
markku.kulmala@helsinki.fi

Centre of Population Genetic Analyses
Professor Pekka Pamilo
Department of Biology
POB 3000
FIN-90014 University of Oulu
tel. +358 8 553 1780
fax +358 8 553 1061
pekka.pamilo@oulu.fi

Microbial Resources Programme
Academy Professor
Kaarina Sivonen
Department of Applied Chemistry and Microbiology
POB 56 (Viikki Biocenter)
FIN-00014 University of Helsinki
tel. +358 9 191 59270
fax +358 9 191 59322
kaarina.sivonen@helsinki.fi

Developmental Biology Research Program
Professor Irma Thesleff
Institute of Biotechnology
POB 56 (Viikki Biocenter)
FIN-00014 University of Helsinki
tel. +358 9 191 59401
fax +358 9 191 59366
irma.thesleff@helsinki.fi

Formal Methods in Programming
Academy Professor Ralph-Johan Back
Department of Computer Science
Åbo Akademi University
Lemminkäisenkatu 14
FIN-20520 Turku
tel. +358 2 215 4382
fax +358 2 241 0154
backrj@abo.fi

From Data to Knowledge
Academy Professor Esko Ukkonen
Department of Computer Science
POB 68
FIN-00014 University of Helsinki
tel. +358 9 191 51280
fax +358 9 191 51120
esko.ukkonen@helsinki.fi

Smart and Novel Radios Research Unit
Professor Antti Räisänen
Helsinki University of Technology
Department of Electrical and Communications Engineering
Radio Laboratory
POB 3000
FIN-02015 TKK
tel. +358 9 451 2241
fax +358 9 451 2152
antti.raisanen@hut.fi

Geometric Analysis and Mathematical Physics
Professor Pertti Mattila
Department of Mathematics and Statistics
POB 68
FIN-00014 University of Helsinki
tel. +358 9 191 51458
fax +358 9 191 51400
pertti.mattila@helsinki.fi

Bio- and Nanopolymers Research Group
Professor Jukka Seppälä
Helsinki University of Technology
Department of Chemical Technology
Laboratory of Polymer Technology
POB 6100
FIN-02015 TKK
tel. +358 9 451 2614
fax +358 9 451 2622
jukka.seppala@hut.fi