

More than future: Sustainable welfare through sentient machines

The CA-RoboCom Project is the “Coordination Action” which will design and describe the FET Flagship candidate “Robot Companions for Citizens” (RCC). RCC guarantees output oriented research, and transdisciplinary, pan-european collaboration from the beginning. It is addressing the pertinent challenges of humanity through advanced human-scale technology. RCC develops a vision and at the same time defines the structure and governance of the Consortium in order to strengthen financial, ethical and social sustainability, to avoid failures and to improve the return on investment for European society and the European national economies.

Humans have moved beyond their evolutionary inheritance by progressively mastering nature through the use of tools and the development of culture. However, the welfare that has been generated in the developed world is not without challenges and its sustainability is at stake in a number of environments: private, social, economic, urban and our physical environment. The FET Flagship Initiative “Robot Companions for Citizens” (RCC) proposes a across-domain, transformative and game-changing innovation – an ecology of sensing and actuated systems and interlinked technologies, that we call Sentient Machines. By sentience we mean the integration of perception, cognition, emotion and action with a contextual awareness of self, others and environment. No existing machine is sentient in this sense, even the most advanced robot today falls far short. Sentient Machines will fulfil a variety of assistive roles for humanity thanks to their ability to act and interact physically, emotionally, socially and safely with humans. Sentient Machines will be ubiquitous and yet unobtrusive, this new generation of robots will extend the active independent lives of citizens, bolster the labour force, provide key services in our cities, aid us to cope with natural and man-made disasters, maintain our planet, and preserve and support human capabilities and experience. In sum, Sentient Machines are a key enabling technology for the foundation of a new sustainable welfare.

More than research

The vision of RCC will be realized by a multi-disciplinary federated international effort in research and development. The goal of this effort is to identify the principles underlying the embodied perception, cognition, emotion and action of natural sentient systems that make them capable of acting in, interacting with, and adapting to their physical and social environment, and of being sentient of this relationship to the world. RCC will exploit the growing understanding of natural sentience to build its ecology of sentient robots; these may be biomorphic, anthropomorphic or express fully novel body-brain configurations specialized for specific niches. The engineering of sentient machines will advance our understanding of the design principles underlying biological sentience in the natural brains and bodies formed by evolution. Out of this closed loop between science and engineering a new discipline of sentient machines will emerge encompassing the core science and engineering vision, but also studying how sentient machines can be best deployed in an ethically-sound way. At the societal level this new science will also seek to understand emerging social processes in networks of embodied sentient systems both natural and artificial.

More than a vision

RCC is an integrated science- and engineering-driven initiative, whose scientific mission is complex, multiple-disciplinary and broad. Driven by its vision and ambition of Sentient Machines, RCC will involve all pertinent stakeholders – science and technology, society, finance, politics and industry. Given the potential transformative and disruptive effects of RCC in our society, their development and deployment will be based on the broadest possible support platform. A customized structure of project management, controlling and communication based on interactive communication tools will provide the highest possible sustainability and return on investment for European society and its national economies. RCC is designed to be more than future from the very beginning.

Contact:

Prof. Dr. Paolo Dario
CA-RoboCom Project Coordinator
The BioRobotics Institute
Scuola Superiore Sant'Anna
Pisa, Italy
Email: paolo.dario@sssup.it
Mobile: +39 348 886 3117

Prof. Dr. Paul Verschure
CA-RoboCom Project, Contact for Communication
Catalan Institute for Research and Advanced Studies
(ICREA) and Universitat Pompeu Fabra
Barcelona, Spain
Email: paul.verschure@upf.edu
Mobile: +34 678 497 289

GRAPHENE-CA – an EU FET Flagship Pilot

A coordination action on graphene will be funded by the European Commission to develop plans for a 10-year, 1,000 million euro FET flagship. This is an ambitious, large-scale visionary research initiative, aiming at a breakthrough for technological innovation and economic exploitation based on graphene and related two-dimensional materials.

Graphene, a single layer of carbon atoms, may be the most amazing and versatile substance available to mankind. Stronger than diamond, yet lightweight and flexible, graphene enables electrons to flow much faster than silicon. It is also a transparent conductor, combining electrical and optical functionalities in an exceptional way.

Graphene can trigger a smart and sustainable carbon revolution, with profound impact in information and communication technology (ICT) and everyday life. Its unique properties will spawn innovation on an unprecedented scale and scope for high speed, transparent and flexible consumer electronics; novel information processing devices; biosensors; supercapacitors as alternatives to batteries; mechanical components; lightweight composites for cars and planes.

The groundbreaking experiments on graphene in 2004 by European scientists Andre Geim and Konstantin Novoselov were awarded the 2010 Nobel Prize in Physics. Their work has sparked a scientific explosion, best illustrated by the exponential growth of publications and patent applications related to graphene. Huge amounts of human resources and capital are being invested into graphene research and applications in the US, Japan, Korea, Singapore and elsewhere. The first products are expected to enter the market by 2014, according to estimates by Samsung.

The research effort of individual European research groups pioneered graphene science and technology, but a coordinated European level approach is needed to secure a major role for EU in this ongoing technological revolution. The graphene flagship aims to bring together a large, focused, interdisciplinary European research community, acting as a sustainable incubator of new branches of ICT applications, ensuring that European industries will have a major role in this radical technology shift over the next 10 years. An effective transfer of knowledge and technology to industries will enable product development and production.

The graphene flagship already includes over 130 research groups, representing 80 academic and industrial partners in 21 European countries. The coordination action is lead by a consortium of nine partners who pioneered graphene research, innovation, and networking activities. Coordinated by Chalmers University of Technology in Sweden, it includes the Universities of Manchester, Lancaster, and Cambridge in the UK, the Catalan Institute of Nanotechnology in Spain, the Italian National Research Council, the European Science Foundation, AMO GmbH in Germany, and the Nokia corporation. The advisory council includes Nobel Laureates Andre Geim (University of Manchester), Konstantin Novoselov (University of Manchester), Albert Fert (THALES) and Klaus von Klitzing (Max-Planck Institute), the leading graphene theoretician Francisco Guinea (CSIC, Spain), as well as Luigi Colombo (Texas Instruments, USA) and Byung Hee Hong (SKK University, Korea), both pioneers of graphene mass production and graphene-based product development.

The pilot phase coordination action starts on May 1. Its main task is to pave the way for the full, 10-year, 1,000 million euro flagship both in terms of the organizational framework and a scientific and technological roadmap for research and innovation. The action plan for the FET Flagship will be submitted in 2012 to the European Commission, aiming for GRAPHENE to be one of the two flagships launched in 2013.

Project leader GRAPHENE-CA: Jari Kinaret (jari.kinaret@chalmers.se)

Media relations during FET11: Christian Borg (christian.borg@chalmers.se) +46-766-314235

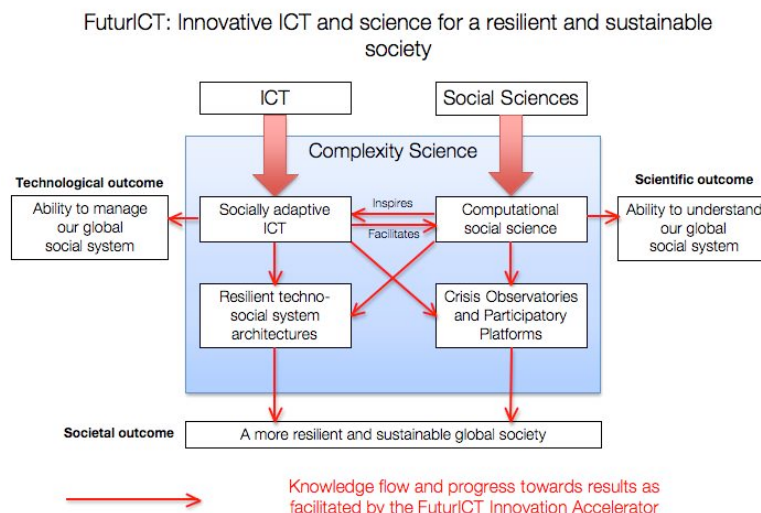
www.graphene-flagship.eu

The FuturICT Knowledge Accelerator:

Creating Socially Interactive Information Technologies for a Sustainable Future

Humanity faces enormous challenges ranging from financial and economic instability over conflict to environmental destruction and climate change, all linked directly to the difficulties in understanding and managing the consequences of our collective activities. Now, a diverse group of leading scientists has unveiled an extraordinary plan to meet these challenges through a project inspired by large-scale enterprises such as the Apollo Project.

The ultimate goal of the FuturICT flagship project is to understand and manage complex, global, socially interactive systems, with a focus on sustainability and resilience. Revealing the hidden laws and processes underlying societies constitutes the most pressing grand challenge of our century and is equally important for the development of novel robust, trustworthy and adaptive information and communication technologies (ICT), based on socially inspired concepts. Integrating ICT, Complexity Science and the Social Sciences will create a paradigm shift, facilitating a symbiotic co-evolution of ICT and society. Data from the complex globe-spanning ICT system will be used to develop models of techno-socio-economic systems. In turn, insights from these models will inform the development of a new generation of socially adaptive, self-organized ICT systems.



The FuturICT Flagship will develop the **Innovation Accelerator** and include:

- **The Living Earth Simulator**, an open participatory platform to simulate global-scale systems involving the interactions of up to 10 billion agents. It will enable the identification of challenges and opportunities on a global scale. The systemic risk analysis will become possible through the integration of a number of crisis observatories.
- **Crisis Observatories**, specialized competence centres running massive data mining and large-scale computer simulations. They will detect possible crises, such as bubbles or crashes in financial markets, reveal advance warning signs of critical shortages, identify risks of wars or social unrests, emerging epidemics, or environmental instabilities, and explore policy options, including their possible side effects.

Contact @ fet11:

Project Leaders: Prof. Steven Bishop (University College London) and Prof. Dirk Helbing (ETH Zurich)

For more information, see: <http://www.futurict.eu> and information stand 26 (The Observatorium/FuturICT)

Visionary Companions: Harvesting Energy for a Smarter Life

The Flagship pilot “Guardian Angels for a Smarter Life” assembles a pan-European network under the leadership of EPFL (Lausanne) and ETH Zurich to create intelligent and autonomous systems serving individuals in their daily lives. It will meet the technological challenge of weaving together energy efficient information processing, sensing, communication and energy harvesting.

Currently, high energy consumption and the short lifespan of batteries are prohibiting the progress of many technological scenarios. The “Guardian Angels” (GA) are envisioned as intelligent, non-intrusive and autonomous devices featuring sensing, computation and communication. The platform will create the ultimate smart device that will assist humans from infancy to old age. One of the key features is its zero power requirements as it will scavenge for energy, a technology that will benefit from bio-inspired concepts.

> Project will use scavenger powered sensors to provide intelligent personal health and safety measures, environmental monitoring and support for disabilities

As personal companions, these Guardian Angels will for instance be used as **individual health support tools** (physical GA). The digital health assistants will be the key to keeping health and day care affordable and accessible to all in the ageing societies of Europe. For example, a growing number of elderly people will be able to maintain their quality of life in their familiar environment, even in cases of reduced mobility or failing cognitive abilities.

Furthermore, Guardian Angel devices will be able to **monitor local ambient conditions** for environmental danger (environmental GA). Communicating with each other, the devices will enlarge the personal radius of sensory perception. For example, natural disaster warnings will be issued individually and without delay. And gaining access to real time data on a grand scale will result in saving energy in heating, transportation and domestic appliances.

Ultimately, the device will also **perceive emotional conditions** and provide helpful functions for the disabled (emotional GA). Thus, for example, quadriplegic patients will be empowered to interact by thought or the autistic will be enabled to read and send out emotions.

Designed in close cooperation with different social actors, interest groups and future users, and paying close attention to environmentally friendly and economically feasible solutions, further beneficial applications for GA technology will be developed over the course of the project. In short, Guardian Angels devices will make our environment more interconnected and smart, more energy efficient and safe.

> Collaboration of more than two dozen universities, research institutions and industrial R&D labs in 13 countries to set new technological paradigms

The Guardian Angels project will address new paradigms: great scientific challenges include energy efficient computing and communication, signal evaluation, algorithms and wireless transmission concepts, novel low power sensing and nano-electro-mechanical systems, ultra low power spintronics and disruptive energy harvesting and storage technologies.

Jointly working towards achieving this scientific breakthrough is a consortium constituted by excellent European research institutions, universities and companies. Together they will strengthen the leading role of Europe in novel zero power technologies, while enabling a stronger role of manufacturing in Europe and improving the competitiveness for leading communication companies.

Co-project leader

EPF Lausanne
Prof Adrian Ionescu
Nanolab
Inst. of Electrical Engineering
School of Engineering
ELB335, Station 11
CH-1015 Lausanne
adrian.ionescu@epfl.ch

Co-project leader

ETH Zurich
Prof Christofer Hierold
Dept of Mechanical and Process
Engineering
Micro and Nanosystems
Tannenstrasse 3
CH-8092 Zurich
hierold@micro.mavt.ethz.ch

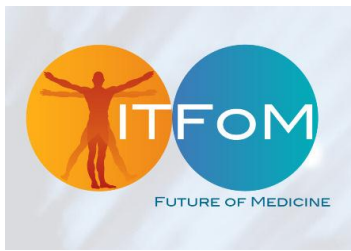
Communication manager

Senarclens, Leu & Partner
Dr Andrea Leu

Klosbachstrasse 107
CH-8032 Zurich
andrea.leu@senarclens.com

Contact in Budapest:

Barbara Simpson, Deputy Communication Manager: +41 76 523 23 50



IT Future of Medicine -ITFoM

In the past, innovation in ICT and computing has been primarily driven by the requirements of “large” physics and a broad spectrum of commercial applications such as entertainment. Medicine has played a relatively minor role. This is set to change. Specifically, the growing demands of data-rich, individualised medicine are likely to surpass those of all other ICT development fields. As data-intensive analysis and computer intensive modelling become common clinical practice, ICT capacity and organization will become key limiting factors in medicine. This will result in a shift of resources from personnel-intensive to ICT-intensive applications. Clinical needs will be the driving force behind future ICT innovation.

Data-rich, individualised medicine poses unprecedented challenges for ICT - in terms of hardware, storage and communication. Making personalised medicine a reality will thus require fundamental advances in the computational sciences. It is with this in mind that Information Technology Future of Medicine (ITFoM) brings together world leading research groups from across Europe and beyond. ITFoM proposes a medicine based on molecular, physiological, anatomical and environmental data from individual patients. Using these data, ITFoM will develop general models of human pathways, tissues, diseases and ultimately of the human as a whole. Individualised models for each patient (the virtual patient) will then be used to identify personalised prevention/therapy schedules and potential side effects of treatment regimes.

To develop this ICT-driven medicine of the future, ITFoM will prepare for the amalgamation of four major areas. The first is medicine itself - from specimen analysis and diagnosis provision to clinical practice and patient consent. The second concerns analytical techniques, covering functional genomics and imaging technology analyses on a routine basis. The third focuses on integration, developing tools required to incorporate the gathered clinical data, and generated analytical data into models that will inform relevant health providers. The fourth area involves the ICT developments required to tackle the immense computational challenges. This is the first time that the ICT implications of worldwide individualized patient care will be addressed in combination with genomics and medical requirements. Academic groups from a range of research backgrounds will join forces with their industry-based colleagues in making this proposal a reality. These research backgrounds include: exploring the potential of novel computing architectures; probabilistic programming languages; information processing paradigms; mathematical methods to model the complexity of biological systems; statistical machine learning methods to predict probable patient responses to combinations of drugs; and algorithms to search for optimal combinations of complex interacting therapies.

The ultimate goals of ITFoM are twofold. The first goal is to give each patient's doctor the power to analyse a person's human genome at every stage of disease management – through diagnosis, treatment and follow-up. This will require a revolution in ICT technologies so that relevant computing, storage, networking and modeling technologies are developed. The second goal is to enable the connection of high throughput biomolecular characterization and clinical imaging technologies. Beneficiaries of this linkage will include: the patient and their doctor; drug researchers in both the discovery and development phases; epidemiologists attempting to analyse health trends; and policy- and decision-makers developing effective national and EU-wide health policy options and legislation. Enabling this connection will require a revolution in integrated information management and decision making. This constitutes a fundamental transformation of biomedical science – from probability-based and empirical to evidence-based and knowledge-driven.

The project outcomes will enable the prediction of health, disease, therapy and its effects for individual patients and through application in the clinic will change the future of medicine.

Contact:

Prof. Hans Lehrach,

Max Planck Institute for Molecular Genetics, Berlin, Germany

Tel: +49 30 8413 1220 (at the fet11 conference : mobile +49 172 3839194)

Email: lehrach@molgen.mpg.de

Web page: www.ITFoM.eu

The Human Brain Project in Brief

The aim of the HBP is to build biologically detailed simulations of the complete human brain and to create the informatics, modeling and supercomputing technologies necessary to do so. The simulations created by the project will serve as the basis for new diagnostic tools and treatments for brain disease, new prosthetic technologies for people with disabilities, a new class of low energy information technologies with brain-like intelligence, and a new generation of intelligent robots.

The human brain can be seen as an immensely powerful, energy efficient, self-repairing, self-teaching computer. If we could understand and mimic the way the brain works, we could revolutionize information technology, medicine and society. This is what the HBP will seek to achieve. To do so, it will bring together everything we know and everything we can learn about the inner workings of the brain's molecules, cells and circuits, collect the knowledge in massive databases, and use it to build biologically detailed simulations of the complete human brain.

The benefits for society will be huge. Even before the project achieves its final goals, HBP brain models will revolutionize information technology, making it possible to design computers, robots, sensors and other devices far more powerful, more intelligent and more energy efficient than today. Brain models will help us understand the root causes of brain diseases, and to diagnose them early, when they can still be treated. They will make it easier to develop new cures for brain disease, reducing our reliance on animal testing. They will help us understand how the brain ages, and how to slow these changes and nurture a healthy brain for our children. In summary, the HBP will produce dramatic advances in technology, a new understanding of the way the brain works and a new ability to cure its diseases.

Achieving all this will require breakthroughs in mathematics and software engineering, an international supercomputing facility more powerful than any before and a strong sense of social responsibility. The HBP has all the necessary resources. The project team will include many of Europe's best neuroscientists, doctors, physicists, mathematicians, computer engineers and ethicists. Experimental and clinical data is accumulating exponentially. Computers powerful enough to meet the project's initial requirements are already here. As technology progresses and the project discovers new principles of brain design it will build ever more realistic models that provide an ever deeper understanding of the brain and ever more powerful applications.

The HBP will be a European-led project with partners all over the world. The current HBP Consortium consists of 13 universities and research institutions from 9 EU member states and associate members, led by Switzerland's EPFL. The EU has selected the HBP, and five other projects, as candidates projects for its new FET Flagship Program. It is now funding the candidates to conduct pilot studies, which they will complete in April 2012. The studies will cover all relevant scientific, organizational and financial issues. On this basis, the European Commission will select two or more projects to become full-scale Flagship Initiatives. The projects selected will receive significant European and national funding for a period of up to ten years.

Further information at: www.humanbrainproject.eu