FET FLAGSHIPS: what they are and what they will bring

FET (Future and Emerging Technologies) **Flagships** are addressing grand scientific and societal challenges which require a common European research effort and sustained support for a period of up to 10 years. They represent science-driven, large-scale, multidisciplinary research initiatives oriented towards a unifying goal, which are expected to result in a transformational impact on science and technology and substantial benefits for European competitiveness and society. The goals of such initiatives are visionary and highly ambitious in terms of scientific challenges, resources required and coordination for efforts. They require cooperation among a range of disciplines, communities and programmes, including national and European initiatives. FET Flagships are implemented as partnerships that enable effective coordination of joint efforts, allowing to feed the whole value-chain and boosting European innovation.

The Flagships will involve many of the most brilliant scientists (and their organisations) in the Flagships' fields of expertise and will tackle a number of science-based challenges that require a strong investment over a long period of time. The overarching nature and magnitude of the FET Flagships imply that they can only be realised through a joint effort of key stakeholders, aligning programmes and resources from the EU and Member States.

Opportunities for participation: Flagships are designed to be open and will enable research on alternative paths and methodologies. Therefore, the partnership composition will be flexible, and a budget reserved for competitive open calls in each Flagship will enable new partners to join. More specifically, Flagships will devote in the order 20% of their resources in the ramp-up phase to an open call for new partners to join the consortium; the open calls will enable new expertise to be brought into the Flagships in response to the evolution of the scientific and technological roadmaps.

Cooperation with EU Member States: Flagships will be implemented through common efforts of EC and the Member States. Member States are investing in these topics and building on the Flagships' scientific roadmaps when setting their agendas. It is important that their efforts are taken into account towards the same final goal, to contribute to the flagship program. The investments of the UK in Graphene and of Hungary in Brain Research are a good start. Member States will also coordinate their activities at European level and are planning to launch calls for projects through an ERANET action.

Beyond Europe: *Graphene and HBP* will foster international collaboration with relevant global partners; these collaborations can be at the level of researchers, institutions or even funding agencies for joint calls. Being aware of this fact, both flagships take international cooperation seriously and have already built bridges with outstanding non-EU partners and programmes which will serve as stepping stones for building global alliances at the institutional and political level.

How will Flagships develop in the next 10 years?

The European Commission will support both flagships for up to 10 years through its research and innovation funding programmes. In the first phase, from October 2013, each will receive up to €54 million from the European Commission's ICT 2013 Work Programme. From 2014 to 2020 the Commission's contribution in the order of 50 M € /p.a./flagship will come from the Horizon 2020 Research Programme. There will be careful monitoring during the lifetime of the projects so that the flagships continue to be an efficient use of tax-payers' money. It is clear that implementation of Graphene and HBP will require coherence and possible synergies across several parts of Horizon 2020, as well as with other programmes (e.g. Structural Funds).

Expected results

The topics of the two selected FET Flagships have not only a strategic importance for Europe but for the entire world. Both flagships will bring advances to science, technology and benefits for the whole of the society. Moreover, these large-scale initiatives will serve as engines for future growth and jobs, making Europe more competitive and more attractive as 'the place' for innovative ideas and excellence in science.

> *"There aren't just two winners. There are 500 million winners"*
> EC Vice President Neelie Kroes

Investing in Flagships is investing in research and innovation to find new products, new solutions, new opportunities that benefit every European. Graphene will, for instance, enable bendable ultrathin phones and other devices that could be wearable, opening the range of communication possibilities to an unthinkable level; it will produce materials that are unbreakable and unscratchable and can be used effectively in cars and airplanes making them ultra-light and energy-efficient. It will be a technological revolution that will affect everyone. The Human Brain Project will have a profound effect on understanding the functioning of healthy and diseased brains, thus leading to early personal diagnosis and treatment of mental diseases like Alzheimer. It will produce new concepts for revolutionary computers that work like the brain, using far less energy than current technology.

European Commission
Directorate General for Communications Networks, Content and Technology (DG CONNECT)

Directorate C "Excellence in Science"
Unit C.4 'Flagships'

FETFlagships FET Flagships

http://cordis.europa.eu/fp7/ict/programme/fet/flagship/

http://ec.europa.eu/digital-agenda/en/fet-flagships

http://www.graphene-flagship.eu

http://www.humanbrainproject.eu/

Flagships Info desk:
cnect-flagship@ec.europa.eu

Mail address:
European Commission
DG CONNECT- C4
BU 33 05/21
B-1049 Brussels
Belgium

Email:
cnect-flagship@ec.europa.eu

©European Commission 2013

FET Flagships

European Partnerships for Scientific Leadership in Future and Emerging Technologies

Graphene-Based Revolutions in ICT and Beyond

The Human Brain Project

"These fantastic flagship programmes show the benefits of working together across Europe, the home of scientific excellence. This fundamental research is transforming everything from building tomorrow's microchips to understanding the human brain. This is not merely 'nice to have' research, this is the 'must have' research we have to invest in to secure Europe's competitive future."

EC Vice President Neelie Kroes

In January, 2013 the European Commission announced the two selected projects *of* the Future and Emerging Technologies (FET) Flagships competitive call. The Graphene and Human Brain initiatives aim to deliver 10 years of world-beating science and innovation. The EC is expected to provide funding of 500 M € over this period, with matching funding from Member States and other sources. Each initiative involves researchers from at least 15 EU Member States and more than 150 institutions (both research institutes and organizations). Moreover, these FET Flagships activities will extend beyond research, addressing aspects such as coordination, strategy development, mobility programmes, international cooperation, road-mapping activity, training and education, outreach, communication and PR activities.

From left to right: Graphene Flagship coordinator Professor Jari Kinaret from the Chalmers University of Technology (Sweden), Neelie Kroes, Vice-President of the European Commission responsible for the Digital Agenda and Professor Henry Markram from EPFL, Switzerland, coordinator of the "Human Brain Project".
© Photo European Commission

Graphene will investigate and exploit the unique properties of a revolutionary class of carbon-based materials. Graphene is an extraordinary combination of physical and chemical properties: it is the thinnest material, it conducts electricity much better than copper, it is 100-300 times stronger than steel and it has unique optical properties. The use of Graphene was made possible by European scientists in 2004, and the substance is set to become the wonder material of the 21st century, as plastics were to the 20th century, replacing silicon in ICT products and offering applications in a broad range of sectors, ranging from aerospace to automatic health and energy.

Key partners include*:

Chalmers Tekniskahoegskola AB (Coordinator, SE)
Centre National la Recherche Scientifique (FR)
The Chancellor, Masters and Scholars of the University of Cambridge (UK)
University of Manchester (UK)
Consiglio Nazionale Delle Ricerche (IT)
Agencia Estatal Consejo Superior de Investigaciones Cientificas (ES)
Commissariat a l'energie Atomique et aux energies Alternatives (FR)
Nokia UK Limited (UK)
Technische Universiteit Delft (NL)

Human Brain Project will create the world's largest experimental facility for developing the most detailed model of the brain, for studying how the human brain works, to develop the next generation of supercomputers, neuromorphic hardware and robot brains and ultimately to develop personalised treatment of neurological and related diseases. This research lays the scientific and technical foundations for medical progress that has the potential to dramatically improve the quality of life for millions of Europeans.

Key partners include*:

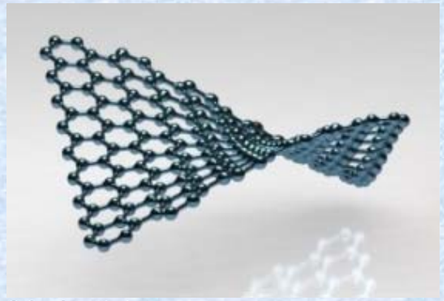
Ecole Polytechnique Federale de Lausanne (Coordinator, CH)
Ruprecht-Karls-Universitaet Heidelberg (DE)
Forschungszentrum Juelich Gmbh (DE)
Centre National de la Recerche Scientifique (FR)
Karolinskainstitutet (SE)
Universidad Politecnicade Madrid (ES)
Technische Universitaet Muenchen (DE)
The University of Edinburgh (UK)
Hospices Cantonaux Chuv (CH)

**List of 9 Key beneficiaries in Ramp-up phase.*

FET Flagship: **GRAPHENE**

www.graphene-flagship.eu

The studies of Graphene were pioneered back in 1961 when Graphene - a single sheet of carbon atoms - was isolated for the first time. However, it was not until the breakthrough in 2004 that two scientists at Manchester University first showed how promising this material is. On a fine Friday afternoon, they were playing with graphite flakes to see how well they conducted electricity and kept on delaminating these flakes, making them thinner and thinner with the help of scotch tape. They discovered they were able to make Graphene, one-atom thick layer. This discovery has led to Nobel prizes and a grand European science research project to develop the wonder material of the 21st century



© Graphene Project

"Graphene is probably the only system where ideas from quantum field theory can lead to patentable innovations."
Nobel Laureate Frank Wilczek

What is Graphene?

Graphene, a single layer of carbon atoms, may be the most amazing and versatile substance available to mankind. Stronger than steel, yet lightweight and flexible, Graphene also conducts electricity much better than copper or 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 not only in ICT but far beyond, in our everyday life. Its unique properties will enable innovation on an unprecedented scale and hold promise for high speed, transparent and flexible consumer electronics; novel information processing devices; biosensors; printable electronics; supercapacitors as alternatives to batteries for cars and portable appliances, and ultralight composites for cars and planes.

The Flagship Project will be coordinated by Professor Jari Kinaret from Chalmers University of Technology in Gothenburg, supported by a Strategic Advisory Council that includes the European Nobel Laureates Albert Fert, Sir Andre Geim, Klaus von Klitzing and Sir Kostya Novoselov.

A third revolution

Carbon has already been the driving force behind two technological revolutions: energy production in the 19th century and plastics in the 20th century. Now carbon promises a third revolution, from ICT and far beyond. The Graphene flagship will put Europe's electronics industry at the heart of innovation with implications in many other areas.

Energy, Health and Medicine

The prospect of rapidly chargeable lightweight batteries gives environmentally friendly transportation a major push and advances the large scale implementation of electric cars as a key component in urban and suburban transportation in Europe. Strong and lightweight composites would allow us to build new cars, airplanes and other structures using less material and energy, and contribute directly to a more sustainable Europe.
Graphene could also have a large impact in health and medicine: for instance, developing artificial retinas, bio-sensors and biological imaging (that could help in cancer treatment). Patents have also been filed on the use of Graphene in drug delivery.

"The Future is coming. With this project, Europe could become the leader in the study of Graphene and its related industrial and commercial applications. Graphene is a surprisingly versatile nanomaterial. The whole CNR scientific community is proud and satisfied with the impressive and excellent results of the unified and enthusiastic efforts put in by its researchers and scientist in one of the most ambitious and challenging EU research programs."

Prof. Luigi Nicolais, President of the National Research Council, Italy

"Graphene happens to be an area where we, in Europe, have all the important players in the value chain who are ready to use it in applications. From that perspective, this is a very efficient and promising way of doing research investments for Europe."

Dr. Henry Tirri, Executive Vice President, Chief Technology Officer at Nokia, Finland

FET Flagship: **HUMAN BRAIN PROJECT**

www.humanbrainproject.eu

Today when doctors prescribe drugs for diseases like Alzheimer's, they cannot accurately predict how these will work for each person. Imagine a future in which it is possible to test how the new drug works on your grandmother's brain by running a computer simulation on the precise model of her own brain. Imagine that in the same way it's also possible to determine what exact combination of drugs your grandmother should take.

Simulating a human brain

The understanding of the human brain is one of the greatest challenges facing 21st century science. The long term goal of the Human Brain Project is to build the informatics, modelling, and supercomputing technologies that are needed to simulate and understand the human brain. Using supercomputer-based simulation technology, HBP will allow for new diagnostic tools and treatments for brain disease, new interfaces to the brain, new types of low-energy technologies with brain-like intelligence, and a new generation of brain-enabled robots.

To accomplish these goals HBO will **build six Research Platforms for the Scientific Community:**
- **The Neuroinformatics Platform**: bringing together data and knowledge from neuroscientists around the world to act as input and validated by
- **The Brain Simulation Platform**: integrating existing data in unifying computer models across scales, making it possible to identify missing data;
- **The High Performance Computing Platform**: providing the interactive supercomputing technology neuroscientists need for data-intensive modelling and simulations referred above;
- **The Medical Informatics Platform**: federating clinical data from around the world, providing researchers with new mathematical tools to search for biological signatures of disease that will be confirmed by the Brain Simulation Platform;
- **The Neuromorphic Computing Platform**: developing hardware brain-inspired devices that will help, in turn, to build better supercomputers and brain models.
- **The Neurorobotics Platform**: allowing neuroscience and industry researchers to experiment with virtual robots controlled by brain models developed in the project.

The flagship will be coordinated by Professor Henry Markram from EPFL in Lausanne and will include European Nobel Laureate Torsten Wiesel as chair of its External Advisory Board.

© Human Brain Project

New treatments for brain diseases

Rising healthcare costs and the increasing number of European citizens, who face the burden of caring for relatives with disorders of the brain, mean that a radically new approach is necessary. Today, the causes of most psychiatric and neurological diseases are still unknown or only partially understood. Diagnosis is often based on physical symptoms and is often only possible in the late stages of disease. The Human Brain Project will collect the masses of clinical data available, mining for biological patterns, leading to new ways of diagnosing and classifying brain diseases. This new approach opens up possibilities for new treatments, better identification of potential drug targets and could significantly speed up the process of clinical trials

Future Neuroscience towards an integrative view of data

Neuroscience is generating exponentially growing volumes of data and knowledge on specific aspects of the healthy and diseased brain, in different species, at different ages. Yet despite these incredible advances, we still lack a unified understanding of the brain that can span its multiple levels of organisation, from genes to cognition and behaviour. This will require bringing the best scientist working together in the development of radically new ICT: new supercomputing technologies to federate and manage the data, to integrate it in computer models and simulations of the brain, to identify patterns and organisational principles and to identify gaps to be filled by new experiments.

"The human brain is the most complex and amazing structure in the universe, yet we are very far from understanding it. In a way, we are strangers to ourselves. Unravelling the mysteries of the brain will help us understand our functioning, our choices, and ultimately ourselves."
Shimon Peres, President, State of Israel

"HBP will be a driving force to develop new and still more powerful computers to handle the massive accumulation of new information about the brain, while the neuroscientists are ready to use these new tools in their laboratories. The research can also give rise to fundamentally new computer architectures modelled after the brain. This co-operation should lead to new concepts and a deeper understanding of the brain, the most complex and intricate creation on earth."

Nobel Laureate Torsten Wiesel

"Next to theory and experiment, the simulations produced by supercomputers have become the third pillar of science. The simulation of the human brain allows us a better understanding of how it works. Using this new knowledge to enter a new era of information technology is a fascinating endeavour. This project is also an honour for Germany as a location for supercomputing."

Annette Schavan, Former Federal Minister of Education and Research, Germany