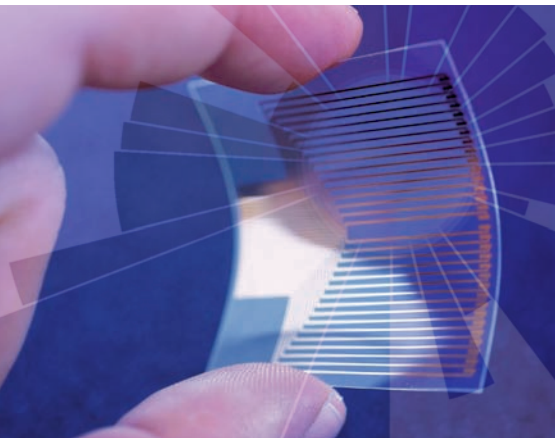
CALL 2009

Project profile

CAJAL4EU

Chip architectures by joint associated labs for European diagnostics



The main objective of the ENIAC JU project CAJAL4EU is to develop miniaturised biosensor technology platforms enabling diagnostic test manufacturers to build multi-parameter *in-vitro* test applications rapidly in a robust, user-friendly and cost-effective way. They will involve nanoelectronic-based transducers with chemical sensing capabilities providing the interface with the clinical samples. In contrast to other biosensor technologies, these devices will be capable of integration with low-cost CMOS nanoelectronics. The cost of a nanoelectronic biosensor can be ultra low at high volumes.

Sub Programme

- Nanoelectronics for Health and Wellness

An ageing society and the rising standards of healthcare in developed countries mean that medical costs per capita are increasing much more rapidly than the per-capita gross domestic product. There is now a clear drive towards preventive healthcare to reduce medical costs and increase the quality of life. This is leading to technological requirements with functionalities beyond traditional diagnostic methodologies, particularly through the use of on-the-spot, point-of-care diagnostics instead of analysis in a central laboratory. Such a demand can be met by novel and advanced technologies.

New interface approach

In the ENIAC JU project CAJAL4EU, bio-targets will be detected by the measurement of capacitive or impedance changes in the signal generated by the test sample. On-chip electronics will detect very small electrical changes in milliseconds, enabling massively parallel real-time monitoring of biomolecule binding events. Transducers, interface chemistry and spotting technologies, microfluidics, software and hardware developments – and their integration – will all play a crucial role in the creation of fully integrated biosensor systems and lab-on-chip devices.

CAJAL4EU's main deliverables will be the different technologies to be developed such as sensor technology, including biochemical functionality, microfluidics and related hardware and software drivers.

The integrated technology blocks, amounting to a generic system solution, will be tested in demonstrators to verify the success of integration, cost efficiency and biological application relevance. This will be done in close collaboration with end users and medical companies to achieve a valuable impact on European society and its economy.

More personal diagnoses

Currently, the pharmaceutical industry follows a 'one size fits all' approach to achieve economy of scale.

However, recent discoveries indicate that many drugs are ineffective for certain patients. Apart from the potential health risks, current practice also puts unnecessary pressure on the healthcare budget.

The combination of diagnostics and therapy to test the efficacy of drugs for certain patients could overcome these problems. Global treatment systems would then emerge to provide the right treatment, for the right person, at the right time.

To enable this concept of personalised medicine, the current traditional healthcare model would need to be extended to include a communications infrastructure, devices facilitating remote check-ups, on-the-spot diagnostics, more screening diagnostics and frequent check-ups.

Key role for semiconductors

Semiconductor technology can play an important role, offering possibilities such as the ability to add intelligence in miniaturised systems. Such devices offer low cost at high volumes, fast data processing, intelligent integrated systems, miniaturised systems, ultra-low power systems and provide connectivity compatible with standard wireless systems.

A plethora of workable biosensors has been developed for a variety of applications over recent years. However, apart from blood-glucose biosensors and a few other commercial hand-held immunosensors used in clinical diagnostics, only a minimal number of biosensor principles appear to offer commercial success in the near future.

The rationale behind the slow technology transfer to the diagnostics market is attributed to cost considerations, manufacturing constraints and key technical barriers – such as sensitivity, specificity, multiplex capability and reliability.

Portable instrumentation

In CAJAL4EU, nanoelectronics technology modules will be developed to allow the realisation of integrated devices in a cost-effective and miniature format. Miniaturised diagnostic-detection platforms with increased sensitivity, specificity and multiplex capability in human body fluids will be developed to facilitate prototype experiments. The tests could be performed at the bedside, in the clinic, in an ambulance, at emergency centres or at home, depending on the particular diagnostic requirement.

Special attention will be given to the manufacturing potential of the applied solutions. The focus in this ENIAC JU project will be on two important disease groups, namely infectious and cardiovascular diseases, which account for approximately 50% of premature deaths worldwide. Targeted biomarkers are viruses, protein biomarkers, DNA/RNA and serological antibodies.

The CAJAL4EU consortium includes industrial and academic partners at every level of the value chain for biosensor technologies in diagnostic applications. This will ensure that no major technology gaps are overlooked and increase the chances of success in the three-year project.

Nanoelectronics for Health and Wellness

Partners:

- 77 Elektronika
- AlphaSiP
- ATOS Origin
- Audit Diagnostics
- Boschman Technologies
- Budapest University of Technology and Economics
- CEA-Leti
- Centro Nacional de Microelectrónica-CSIC
- Complutense University of Madrid
- Dublin City University
- Fraunhofer IZM
- Galway Tool and Mould
- IMEC
- Institut für Mikrotechnik Mainz (IMM)
- Institute of Advanced Chemistry of Catalonia-CSIC
- Instituto Aragones de Ciencias de la Salud
- Microfluidic ChipShop
- Micronit
- NXP Semiconductors
- Pac Tech
- Radboud University Nijmegen Medical Centre
- Research Institute for Technical Physics and Materials Science (MFA)
- Robert Bosch
- Semmelweis University
- Silex Microsystems
- Sorin CRM
- Stokes Bio
- Tibotec Virco Virology
- Toppan Photomasks

Project co-ordinator:

- Romano Hoofman, NXP Semiconductors

Key project dates:

- Start: March 2010
- Finish: February 2013

Countries involved:

- Belgium
- France
- Germany
- Hungary
- Ireland
- The Netherlands
- Spain
- Sweden

Total budget:

- €22.6 million

The ENIAC Joint Undertaking, set up in February 2008, co-ordinates European nanoelectronics research activities through competitive calls for proposals. It takes public-private partnerships to the next level, bringing together the ENIAC member states, the European Commission and AENEAS, the association of R&D actors in this field, to foster growth and reinforce sustainable European competitiveness.

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