
## The POSITIVE consortium…

- will develop a label-free biosensor for the point of care evaluation of food allergy risks
- will create disposable lab-on-chip cartridges with integrated microfluidic sample preparation and ultrasensitive photonic transducers, as well as a bench-top readout system
- focuses on a rapid solution (<15 minutes) with little hands-on time, so as to be used at point of care in an intensive care unit by paramedics and General Practitioners
- consists of six research centres and two industry partners from seven European countries
- is supported during 2008-2011 with 2.9 Million Euro by the European Union through its Seventh Framework Programme.

SEVENTH FRAMEWORK PROGRAMME

POSITIVE

# A highly integrated and sensitive POrous multiple quantitaTIVE monitoring of Food

## Food allergy as a condition and current diagnostic methods

Food allergies can provoke clinical reactions whose most severe is anaphylaxis, with respiratory and/or cardiovascular problems that might result in death. They are common in 1-2% of adults and up to 8% of children, corresponding to a serious public health problem that affects over **15 million people in Europe** from infants to the elderly and its prevalence is increasing.

The skin prick test is the most commonly used test for allergy diagnostics. However, this test has its limitation in patients with severe allergic reactions (anaphylaxis), eczema, taking anti-histamines and young children, where the tests are difficult to administer. Unfortunately, food allergy is most frequently seen in young children with eczema and/or severe reaction in the past.

Therefore, blood based tests, mostly using the FEIA, RAST and ELISA techniques are often used. These tests are normally performed as a laboratory test using sent-in blood samples. On the other hand point-of-care (PoC) devices exist; however, they are currently able to assay only few allergens at a time. Other immunological blood tests, using enzymes, are now superseding the original methodology. Moreover, the existing market PoC products provide at best semi-quantitative determination of allergy sensitization.

## Lab-on-chip technology for rapid and low cost quantative determination of hundreds of food allergies

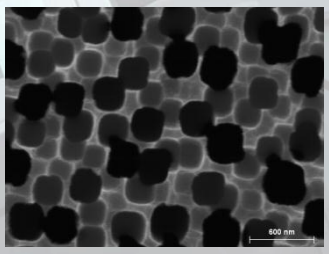
POSITIVE is developing a state-of-the-art diagnostics Lab-on-a-Chip platform via an integrated microfluidic sample preparation technique capable of serum preparation from whole blood of volumes, <100µl. A final prototype consisting of a packaged biochip and reader will be used on clinical samples in order to determine sensitization to allergens such as that for hen's eggs, cow's milk, peanuts, wheat, tree nuts, fish, sesame, and shrimp ingestion.

# SIlicon based lab on a chip for allergies at point of care.

### Porous silicon transducers provide optical readout

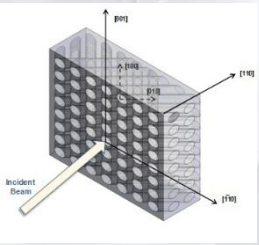
Porous silicon (porSi) is an almost ideal material as a signal transducer for *label free optical biological sensing* with many advantages, which include:

(1) ease of fabrication (by the electrochemical etching of a silicon wafer in hydrofluoric acid) of high-quality optical elements with a nanoporous sponge-like structure,
(2) the possibility of integration with wafer level IC processing (porSi is widely exploited as a sacrificial material in micromachining technology and as a buffer layer in realization of microsensors and microsystems),
(3) an extremely large internal surface (~500 $m^2/cm^3$) that can in principle be leveraged to enhance device sensitivity many orders of magnitude over a planar device of comparable transducer diameter,
(4) pore sizes tunable across biologically relevant length scales,
(5) convenient covalent and non-covalent surface chemistry.

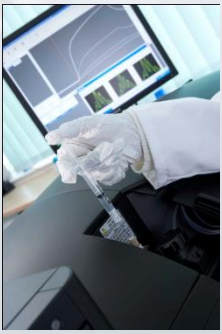



Porous silicon sample made at UNITN, electron microscope image courtesy of University of Valencia

Polarimetry schematic, courtesy of University of Valencia




Recently, sufficiently high optical quality porSi for inexpensive multiple optical biosensors compatible with a present-day on-chip microelectronics and nanophotonics productions has become available. This has permitted us to propose two different types of biosensing optical elements in this project with predetermined porous layer morphology. Due to their small size, many sensors can be put next to each other on a single photonic chip. Their limit of detection and selectivity will approach the state of the art for highly integrated label-free lab on a chip devices. Technology is also being developed to couple in and read out light from the entire biosensor array at once with a low cost reader.



# The POSITIVE Consortium

**KTH – the Royal Institute of Technology** The **Microsystem Technology Lab** is a leading MEMS and microfluidics group. It coordinates the project and leads the intgeration of the biochip.
Contact: Prof. Wouter van der Wijngaart, wouter@ee.kth.se, URL: www.ee.kth.se/mst

**Centre Suisse d'Electronique et de Microtechnique** is an applied R&D center specializing in micro- & nanotechnology, microelectronics, and system engineering. It leads the fluidic and optical measurement platform development and also contributes to the microfluidic sample handling and microsystem packaging.
Contact: Dr. Helmut Knapp, Helmut.KNAPP@csem.ch, URL: www.csem.ch

**Farfield Group Ltd** is a UK instrumentation company specializing in measurement of conformational changes in proteins for bioanalytical purposes. Farfield's technology measures sub atomic dimensional changes in proteins implicated in a host of disease processes and is used to study the disease mechanism and drug candidates to inhibit it.
Contact: Dr. Gerry Ronan, gronan@farfield-group.com, URL: www.farfield-group.com

**Charite Universitaetsmedizin Berlin i**s one of Europe's largest university hospitals, the department of pediatric pneumology and immunology focuses on the development of better diagnostic and therapeutic approaches for allergic diseases including food allergy.
Contact: Dr. Kirsten Beyer, Kirsten.Beyer@charite.de, URL: www.charite.de

**Phylogene SA** is a specialized R&D and service laboratory located in the south of France that has developed a range of tests to allow allergen tracking in food.
Contact: Dr. Gilbert Skorski, g.skorski@phylogene.com, URL: www.phylogene.com

**Università degli Studi Di Trento -** The Nanoscience Laboratory is within the Physics Department of the University of Trento. The activities of the laboratory are along three main research lines: silicon photonics, nanophotonics and nano-biotechnologies.
Contact: Prof. Lorenzo Pavesi, pavesi@science.unitn.it, URL: science.unitn.it/~semicon/

**Consiglio Nazionale Delle Ricerche -** The Institute of Molecular Recognition Chemistry (ICRM), based in Milan, is one of the several research institutes of Italian National Research Council (CNR).
Contact: Dr. Marcella Chiari, marcella.chiari@icrm.cnr.it, URL: www.icrm.cnr.it

**Universitat de Valencia** is one of the oldest, largest and most important universities in Spain and participates through the Unit of Materials and Optoelectronic Devices (UMDO) from within the Institute of Materials Science (ICMUV).
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