# *2nd activity report: Laboratory Skin Patches and SmartCards based on foils and compatible with a Smartphone*

## *LABONFOIL*

## *EU Large-scale integrating project (N. 224306)*


## Summary

Budget: 7,100,000€; Funded: 5,300,000€ (74.65%)

Duration: 48 months (2008-2011)

Co-ordinator: Jesus M Ruano-López from Ikerlan-IK4.


**Fig.** 1 Logos of the LABONFOIL partners

## Main Objective

To develop four LOCs with four different applications and one fabrication equipment (See Fig. 2).

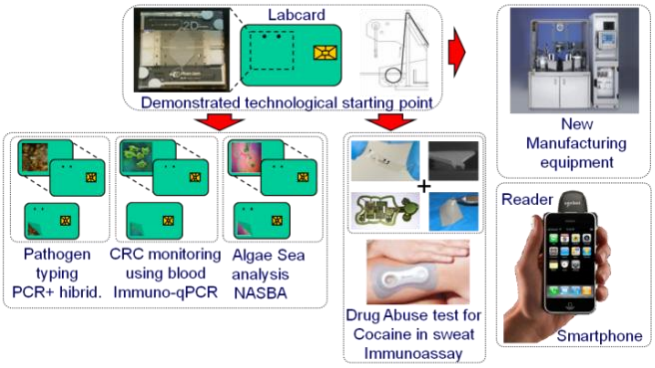


**Fig. 2:** Description of the equipment and applications. Three Labcards, a Skinpatch, a reader-smartphone and Dry film Lamination equipment.

The future mass production of these novel diagnostic components will be guaranteed by the development of manufacture truly ultra-low-cost Lab-on-a-chip Microsystems. The dramatic cost reduction will be based on the use of large films instead of wafer substrate.

The smart mobile phone will offer a vast range of straightforward communication and interface capabilities. This strategy will turn a Smartphone into a portable diagnostic device. The Labcards and skin patches will demonstrate the wide range of applications and the potential of the technology.

## Project mission

In order to provide cohesion and motivation to the consortium, the researchers of LABONFOIL discussed the mission of this project reaching the following mission statement: «*To create and demonstrate an innovative capability and economy in point of care systems for the benefit of society through rapid, ubiquitous and minimally invasive diagnostic devices for health and environment*».

## 2nd year work

This year main technical actions have been: (i) to transfer the tube reactions to a one chamber chip reactor, (ii) to fabricate the one chamber reactors and readers; (iii) to design Labcards, Skinpatch, and their respective readers; (iv) to fabricate and integrate the first version of a Labcard, Skinpatch and reader; and (v) to design the fabrication tool for mass production including a low temperature bonding technique.

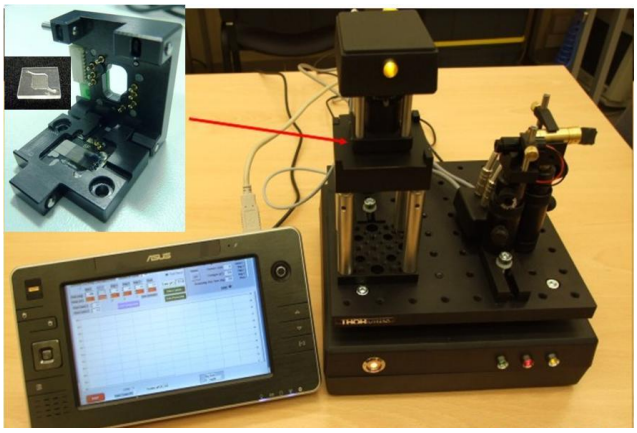

**Fig. 3:** Collage of pictures: One chamber chip reactor, thermal holder, and the two wavelengths fluorescence reader for environmental. Picture from Ikerlan-IK4 and PWR.

Ikerlan-IK4 provided COC one chamber chip reactors made of COC to NERC, Gaiker-IK4 and DTU-Vet. This strategy has allowed us to carry out easily all the single reactions on chip these partners demanded. Ikerlan also sent an improved packaging

capsule. PWR and Ikerlan-IK4 have provided also a two wavelength reader to NERC (see Figure 3).

This strategy has provided good chip bio-results and important information for the design of the final readers, Skinpatch and Labcards. This information was used to unify connections and interfaces. Three labcards have been designed for each application. A validation labcard has been fabricated (see Figure 4) plus Skinpatches (see Figure 5). In fact, we have brought forward some preliminary results using a developed verification labcard and platform (See Figure 7). These experiments have provided important information about the labcard performance (data not shown). Now we will fabricate final validation Labcards and Skinpatches to carry out the reactions described in the DoW: environmental, food, CRC monitoring and drug abuse.

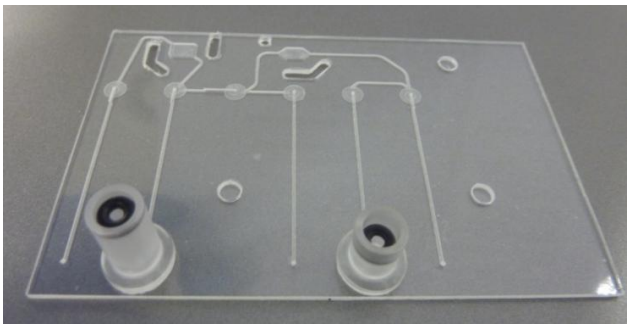

**Fig. 4:** Picture of the verification labcard (Picture from IKERLAN-IK4).

Regarding the Skinpatch, Biosensia continued in order to optimise the bio-molecular reactions to the point where they can be integrated into a Skinpatch device. Last year we had a lateral flow strip, this year we have achieved a Lab-on-a-Paper. The achievements made here aimed at integrating fluidic, immuno assay and optical components of the Skinpatch into a wearable device and demonstrating that key functions of the device are working. Finally, PWR has created a handheld Skinpatch reader.

**Fig. 5:** Pictures of the developed labonapaper (left) and its reader (right). Pictures from Biosensia and PWR.

A new OLED generation was fabricated with more emitted intensity. FhG successfully integrated an integrated fluorescence emission filter on top of the OLED. They also have produced the first Labonfoil flexible OLEDs using equipment developed in collaboration with a German project.

The Fabrication equipment is in progress. EVGroup has designed the equipment taken into account the Labcard fabrication protocols needed. As planned, the fabrication of the tool will start in the 3rd year.

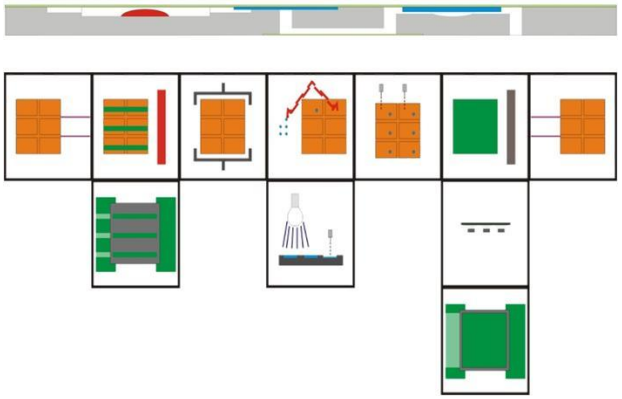

**Fig. 6:** Schematic representation of the labcard cross section (top) and fabrication tool components (bottom).

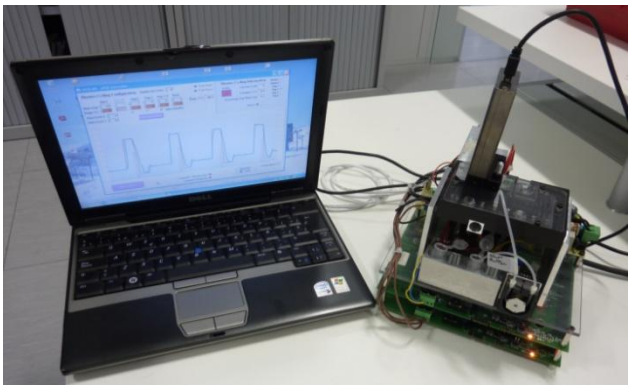

**Fig. 7:** Picture of the developed labcard platform with the needed actuators for automatic sample preparation and detection.

Regulatory has been involved in the acquisition of blood samples from the Hospital de Cruces (CRC application), and Biosensia studied the needed legal arrangements to pursue a Skinpatch validation. It also studied the required standards as well as the regulatory issues for the safety of the prototypes. Labonfoil had an agreement with the International conference nanotech (www.nanotech-montreux.com) to have a parallel session of Labonfoil results and also a booth. Five public media news were created in newspapers in comparison with one in 2008 and two in 2009. The

Labonfoil web (www.labonfoil.eu) has installed Google analytics to analyze the visits.


**Fig. 6:** Picture of comic cover and the first page of one of the four stories describing the Labonfoil applications and envisioned products. You can download a copy in http://www.labonfoil.eu/media/media.htm.

A comic describing the four applications has been finalized and distributed among interested exploitators and potential end-users (see Figure 6 or www.labonfoil.eu/media/media.htm). An intellectual property list has been prepared with different topics. Scientific papers are being prepared once we defined the patent strategy. Biotools and Ikerlan-Ik4 organized a workshop in Madrid to discuss about a trend opened in the last Labonfoil workshop in London: the potential of PoC devices in emerging and third developing countries. The next one is going to be in Wroclaw (Poland).

A hand to hand meeting with Danish poultry companies was arranged and also a private meeting with an egg producer was carried out. There is an agreement of two Labonfoil partner to work together with this company. There is also an initiative of three partners (Ikerlan-IK4, Gaiker-IK4 and Biotools) to create a spinoff company to exploit this partner's knowledge. These three partner created a legal Association of Economic Interest before the Spinoff is formally created. Two Labonfoil partners and an Indian company have signed an agreement to analyze the expertise of these two LabonFoil partners for a set of diseases. Regarding the Skinpatch, a strategy taking into account possible regulatory barriers has been analyzed producing the convenient modifications to the skin patch intended use.

## Results

At this moment, we can not disclosure the biological results obtained by Gaiker-IK4, DTU-Vet, and NERC with the developed components explained above. Neither the results obtained by other partners such as DTU-Nano, University of Southampton, microresist and TATAA. However, what we can make public is the impression of the reviewers during the review held at Ikerlan-IK4 facilities, in Mondragon in the 15th of September 2010. The review consisted of several demonstrations of the developed prototypes (Labcard, Labcard platform, Skinpatch and Skinpatch reader) which were successfully tested through biological reactions. Fruitful discussion took place between reviewers, Project Officer and Labonfoil partners. Finally, the 2nd year technical report was marked with the following sentence: *"Excellent progress: the project has fully achieved its objectives and technical goals for the period and has even exceeded expectations"*

## Next year

We can say that after this second year, we are involved in a process to transfer the chip knowledge to the labcard. As planned, the third year will be dedicated to fabricate the final set of components, and the fourth year these components will be validated.

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