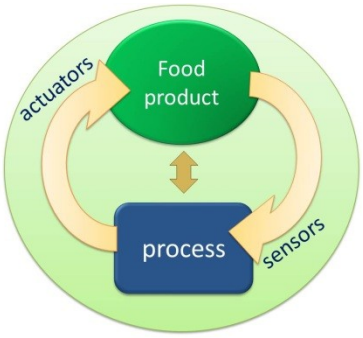
# Validation project Optical Fiber Biosensors

*Affordable and practical Bio-diagnostics in the Food Industry*

## General project information

In a new approved IWT-VIS-project, called 'Sensors For Food', **Flanders' Food** and research partners from **IMEC**, **KULeuven, VUB** and **IBBT/Ghent University** join forces for four years to evaluate, optimize and validate innovative sensors for applications in the food industry. All this is 80% funded by the Flemish IWT. **Optical fiber biosensors** are among the diverse sensor systems tackled. They have great potential for implementing cost-effective and practical **food safety analyses** in food processing plants. Moreover, they combine high levels of sensitivity and accuracy with improved detection speed. In the following paragraphs more information is given on the broader Sensors For Food project and the specific validation project on optical fiber biosensors. As participant in this validation project, you can also benefit from the services offered by the Sensors For Food platform.

## Sensors For Food Platform



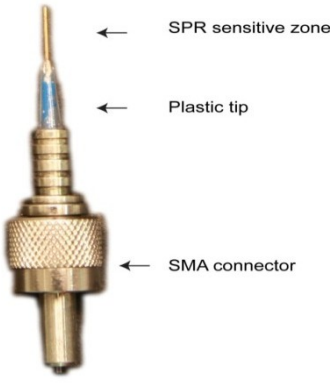
Design, optimisation and control

As a result of the recently finished Intelligence For Food project, the Sensors For Food platform brings food manufacturers and technology providers together in a forum for food industry sensor systems. The aim is to improve, increase the awareness and explore the application of existing, new and upcoming sensor systems for the food industry. Activities include: a screening of needs and opportunities for the food industry, a technology watch on emerging sensor innovations, generation and support of innovative ideas, networking and partner matching between food companies and technology suppliers. Via a centralized contact point, advice is provided concerning sensor systems that are already available for the food industry. For example, assistance is offered for issues regarding sensor calibration and selection. Furthermore, a number of thematic seminars, workshops and training courses will be organized.

*Contact:* Steven.Vancampenhout@flandersfood.com; Veerle.DeGraef@flandersfood.com; Kris.Vandevoorde@imec.be; Bart.DeKetelaere@biw.kuleuven.be; Filip.Delport@biw.kuleuven.be

## Sensors For Food validation project Optical Fiber Biosensor

In a previous IWT innovation project (Intelligence For Food), the optical fiber biosensor, developed by the research group MeBioS of the KULeuven, was identified as a promising innovative sensor system for the detection of (hidden) allergens, GMO's and DNA of micro-organisms and viruses. It is a next generation biosensor system with the potential to allow food companies to perform food safety controls in their production facilities in a practical, fast, quantitative accurate and affordable way.



**Prototype optical fiber biosensor**

A prototype is available for use in the validation path, including demonstrations, field tests, and further knowledge generation, optimization and validation in cooperation with participating companies. The performance of the optical fiber biosensor will be bench marked against current standard techniques such as ELISA and qPCR. The validation project combines technical evaluations (sensitivity, detection limit, stability and degree of sample preparation) together with cost–benefit analyses as well as extended knowledge transfer in the field of detection techniques for allergens, GMO's and micro-organisms in the food industry.

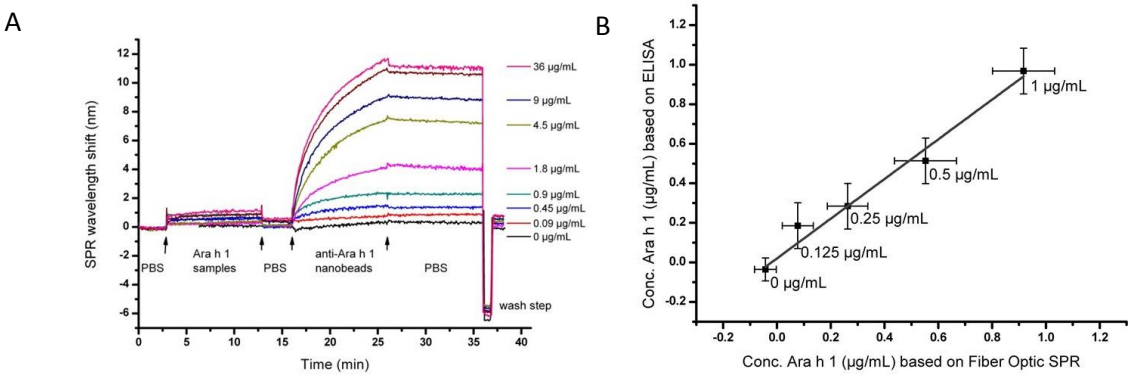
*Contact: Jeroen.Lammertyn@biw.kuleuven.be*

## What do we offer?

Our expertise:

The optical fiber sensor technology has been successfully validated for multiple targets (allergens, serum proteins, micro-organisms, DNA analysis,…). Our **research results** have been **evaluated externally** and **published** at a **high international scientific level**.

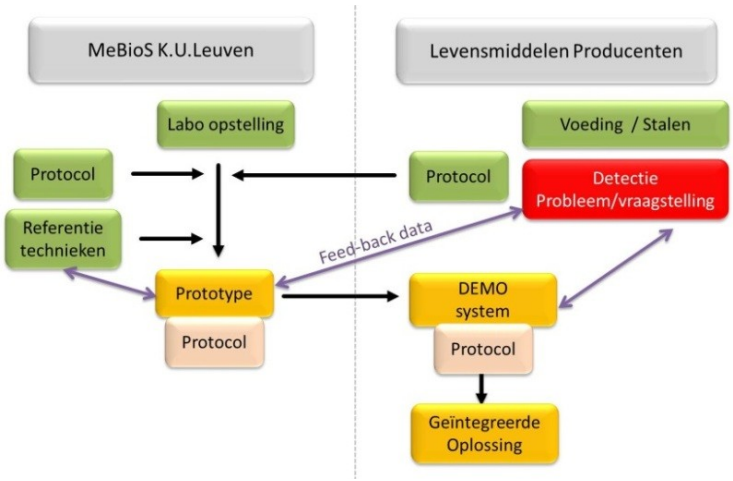

- Knez, K., Janssen, K.P., Pollet, J., Spasic, D., Lammertyn, J. (2012). Fiber-Optic High-Resolution Genetic Screening Using Gold-Labeled Gene Probes. *Small* 2012 Feb 14. doi: 10.1002/smll.201102209.
- Delport, F., Pollet, J., Janssen, K., Verbruggen, B., Knez, K., Spasic, D., Lammertyn, J. (2012). Real-time monitoring of DNA hybridization and melting processes using a fiber optic sensor. Nanotechnology, 23 (6), 065503. [Epub ahead of print].
- Pollet, J., Janssen, K., Knez, K., Lammertyn, J. (2011). Real-Time Monitoring of Solid-Phase PCR Using Fiber-Optic SPR. *Small*,7 (8) 1003-1006.
- Pollet, J., Delport, F., Janssen, K., Tran, T., Wouters, J., Verbiest, T., Lammertyn, J. (2011). Fast and accurate peanut allergen detection with nanobead enhanced optical fiber SPR biosensor. *Talanta, 83* (5), 1436-41.
- Tran, T., Janssen, K., Pollet, J., Lammertyn, E., Anné, J., Van Schepdael, A., Lammertyn, J. (2010). Selection and Characterization of DNA Aptamers for Egg White Lysozyme. *Molecules, 15*, 1127-1140.
- Pollet, J., Delport, F., Janssen, K., Jans, K., Maes, G., Pfeiffer, H., Wevers, M., Lammertyn, J. (2009). Fiber optic SPR biosensing of DNA hybridization and DNA-protein interactions. *Biosens & Bioelect, 25* (4), 864-869.
- Pollet, J., Tran, T., Delport, F., Wevers, M., Lammertyn, J. (2008). Aptamer based surface plasmon resonance probe. *Abstracts of the 7th IEEE conference on sensors,* Lecce, Italy, 26-29 October (pp. 1187-1190) IEEE.


**A) Sensorgram of the optical fiber for the detection of peanut allergen Ara h 1 in chocolate samples (sensor signal in function of time);**
**B) Comparison of the results generated with the optical biosensor (x-axis) with the ELISA reference (y-axis).**

What are the opportunities for you:

These new innovative sensors are **extremely suited for the screening of specific biomolecules or bio-organisms** at an affordable cost in **raw materials, intermediate or end-products as well as in processes like cleaning**. Typical targets are: proteins, toxins, bacteria, viruses, GMO's, allergens, …. Validated ELISA (for protein analysis) and qPCR tests (for DNA analysis) will be applied as reference techniques. After an extensive feasibility study an optimization tailored to your needs and advice for potential implementation will be provided.




**Lab setup and general scheme of the validation project**

Prerequisites for paricipation:

- Membership of Flanders' FOOD (www.flandersfood.com/lid-worden-van-flanders-food)
- Contribute to the funding of the non-subsidized cost of the validation project (20 % of the budget) together with all participating companies.

# Suggested workplan for the validation project Optical Fiber Biosensor

| | Validation project: Optical Fiber Biosensors | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Task | Year 1 | | | | Year 2 | | | | Year 3 | | | | Year 4 | | | |
| | | K1 | K2 | K3 | K4 | K1 | K2 | K3 | K4 | K1 | K2 | K3 | K4 | K1 | K2 | K3 | K4 |
| 1.a | Evaluation lab-setup for model systems | Pr | | | | | | | | | | | | | | | |
| 1.b | Measurements with reference techniques | | | | | | | | | Ra | | | | | | | |
| 2 | Feasibility study demo-FAST on model systems | | | | Pc | | | | | | | | | | | | |
| 3 | Optimization sample preparation for 4 cases | | | Go | | | | | | Sv | | | | | | | |
| 4 | Adjustment prototypes for user friendliness | | | | | | | | | | | | Ge | | | | |
| 5 | Demonstrations in industrial environments | | | | | | | | | | | | | | Wo | | Ei |
| 6 | Specific user group meetings | Sg | | Sg | | Sg | | Sg | | Sg | | Sg | | Sg | | Sg | sEv |

Legend:

Pr Presentation literature investigation and visit MeBioS (Deliverable); Continuous deliverable: technical evaluation of sensitivity, detection limit, stability and sample preparation for multiple model food systems; Continuous deliverable: knowledge transfer

Ra = Report on the comparison of the optical fiber biosensor to the classic techniques concerning sensitivity, detection limit, stability and sample preparation (Deliverable)

Pc = Proof of concept demo-FAST system (technological validation and economic feasibility in diverse food matrices (Technical Milestone)

Go = Go/no Go decision moment for the cases => 4 choices will be made (Strategic Milestone); Sv =Optimized sample preparation protocol (Technical Milestone)

Ge = Ready to use demo-FAST for testing in a company environment (Technical Milestone); Continuous deliverable: knowledge transfer

Continuous deliverable: demonstrations in industrial environments; Continuous deliverable: knowledge transfer; Wo = Workshop Optical Fiber Biosensors (deliverable); Ei = End report + Valorization document (deliverable)

Sg = Specific biannual user group meetings (availability); sEv= specific Final meeting (deliverable)

## Financial contribution of the participating companies

The estimated project contribution per year is dependent on the size of the company, as determined by the total number of employees of the company in the concerned year and is represented in the following table.

| **Number of employees*** | Minimal project contribution (yearly, VAT excl.) | **Estimated project contribution** (yearly, VAT excl)** | Maximal project contribution (yearly,VAT excl.) |
|---|---|---|---|
| **< 50** | 750 € | **1.000 €** | 1.500 € |
| **51-100** | 1.125 € | **1.500 €** | 2.250 € |
| **101-150** | 1.500 € | **2.000 €** | 3.000 € |
| **151-200** | 1.875 € | **2.500 €** | 3.750 € |
| **201-250** | 2.250 € | **3.000 €** | 4.500 € |
| **> 250** | 3.000 € | **4.000 €** | 6.000 € |

* Number of employees of the largest legal entity that will gain access to the results of the project

**Based on the number of companies that had expressed their interest in the Validation project upon submission of the Sensors for Food project application at IWT.

The real yearly project contribution can be higher or lower than the estimated project contribution.
The real yearly project contribution depends on the number and size of the participating companies. The real yearly project contribution has been limited to minimal and maximal project contributions mentioned in the table above.

Participating companies engage themselves to stay a member of the project and Flanders' FOOD for the duration of the project. (see www.flandersfood.com/lid-worden-van-flanders-food).

## Contact details

Prof. Jeroen Lammertyn

*MeBioS Biosensors*
*Willem de Croylaan 42, 3001 Heverlee*
*KU Leuven*
*Belgium*
*(+32) 016320592*
*Jeroen.lammertyn@biw.kuleuven.be*

Dr. Dragana Spasic

*MeBioS Biosensors*
*Willem de Croylaan 42, 3001 Heverlee*
*KU Leuven*
*Belgium*
*(+32) 016328003*
*dragana.spasic@biw.kuleuven.be*