



## **MASTER IN PHOTONICS – “PHOTONICS BCN” ERASMUS+ “EUROPHOTONICS”**

### **MASTER THESIS PROPOSAL**

**Dates: April - September 2019**

**Laboratory:** Laboratory of Photonics and Integrated Optics

**Institution:** Institute of Microelectronics of Barcelona (IMB-CNM, CSIC)

**City, Country:** Bellaterra, Spain

**Title of the master thesis:** *Silk-based Photonic Lateral Flow Devices for Point of Care*

**Name of the master thesis supervisor:** **Xavier Muñoz Berbel/ Tobias Nils Ackermann.**

**Co-supervisor UPC:** **to be determined**

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**Keywords:** silk-fibroin, opto-fluidic light-guides, optoelectronic systems, nano-patterning, opto-fluidic simulations, glucose sensing.

### **Summary of the subject (maximum 1 page):**

In point of care devices, the patient is monitored in the bedside. This is very advantageous since patients can monitor their pathologies in the comfort of their house, without stressful travelling and queuing. Monitoring at home improve the quality of life of the patient and the control of the pathology, reducing, at the same time, the number of hospitalization and visits to the medical doctor, as well as the sanitary costs associated to the pathology. A number of point of care devices are based on the use of paper, being lateral flow devices the commonest in the market. In a lateral flow device, the patient introduces a drop of sample, currently blood or urine. The sample flows through the paper by capillarity and provides the result of the analysis to the user after few minutes and without user intervention. These lateral flow devices are very advantageous but still rely on semi-quantitative data by the variability and heterogeneity of the cellulose matrix. This matrix, composed of randomly distributed cellulose fibers, confers the system with high device-to-device variability, which makes very difficult to obtain the real reference necessary for quantitative absorbance measurements. In an attempt to go a step further, in this master thesis we propose the use of silk-fibroin in the development of the new generation of lateral flow devices which, apart from capillarity, will present high transparency in the visible range, stability and homogeneity enabling quantitative



absorbance measurements. With this objective in mind, we look for a motivated and enthusiastic student with good team working skills to:

1. Design and simulate the photonic and microfluidic behaviour of opto-fluidic waveguides based on silk-fibroin.
2. Manufacturing of the previous structures using micro-nano-fabrication technologies in the Clean Room Facilities at IMB-CNM.
3. Characterize and validate the performance of the opto-fluidic-waveguide. Comparison with theoretical data.
4. Application of the previous structures to biomarkers detection for point of care. Detection of glucose in whole blood samples.

To this end, the following previous knowledge/skills will be very welcome:

1. Knowledge of simulation programs (Comsol Multi-physics, Fimmwave, etc.)
2. Experience in photonic sensing
3. Experience in microfabrication technologies
4. Experience in biomaterials
5. Experience in biosensing