Proposition de stage / Internship proposal

Date de la proposition : 24/10/23

Responsable du stage / *internship supervisor*:

Nom / *name*: ALEXANDROU Prénom/ *first name* : Antigoni

Tél : 01 69 33 50 04 Courriel antigoni.alexandrou@polytechnique.edu

Nom du Laboratoire / *laboratory name*: Laboratoire d'Optique et Biosciences (LOB)

Etablissement / *institution* : Ecole polytechnique Code d'identification :

Site Internet / *web site*: https://lob.ip-paris.fr/

Adresse / *address:* Route de Saclay, Ecole polytechnique, 91128 Palaiseau Cedex

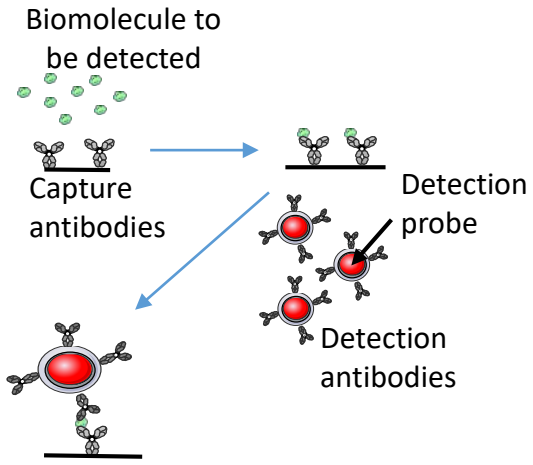
Lieu du stage / *internship place*: Laboratoire d'Optique et Biosciences

Titre du stage / *internship title*: Ultrasensitive detection of proteins and nucleic acids using luminescent nanoparticles: link between sensitivity gain and molecular interaction force

Résumé / *summary*

The in-field detection of pathogens (viruses, toxins) is mainly based on the use of immunoassays (Lateral Flow Assay (LFA)) for the colorimetric detection of proteins using gold particles or on isothermal amplification systems for nucleic acids. However, the sensitivity of these methods remains limited and they generally do not allow quantification. For many infectious diseases, particularly viral diseases, sensitive antigenic methods are not widely used, notably due to the limited availability of appropriate antibodies, and amplification-based methods are the most common, both in the field and in specialized laboratories. However, amplification-based methods are expensive, slow and difficult to multiplex.

In this context, we have developed a highly sensitive, easy-to-use and versatile detection method using luminescent YVO4:Eu nanoparticles as probes, enabling the detection of both proteins (see figure) and nucleic acids. Our method uses a protocol similar to that of existing immunoassays and is 20 to 1,000 times more sensitive than existing methods. However, the gain in sensitivity achieved by our method is highly dependent on the target molecule to be detected.



The internship will focus on understanding this variability in sensitivity gain through:

- surface plasmon resonance (SPR) measurements of the interaction (association and dissociation rate constants) between target molecule and recognition molecule (antibody or complementary oligonucleotide) attached to the nanoparticles
- the effect of the presence of nanoparticles on these constants
- determining the minimum number of nanoparticle probes required for detection.

The trainee will gain experience in surface functionalization, SPR, and the development of LFA or ELISA assays.

A taste for interdisciplinary work is required. Skills in biophysics and/or immunology would be appreciated but are not required.

Toutes les rubriques ci-dessous doivent obligatoirement être remplies

Ce stage pourra-t-il se prolonger en thèse ? *Possibility of a PhD* **? : To be discussed**

Si oui, financement de thèse envisagé ou acquis / *financial support for the PhD* **? No**

Financement acquis / *Secured funding*		Nature du financement */Type of funding*	
Financement demandé / *Requested funding*		Nature du financement */Type of funding*	