**Biosensors of Bacteria based on fluorescent nanomaterials**

The detection of pathogenic bacteria is of the utmost importance in the food industry, in water and environmental quality control, and in clinical diagnostics for health and safety reasons. Various bacteria have been identified as important food and waterborne pathogens. Effective detection of pathogenic bacteria requires analytical methods to meet a number of demanding criteria, with high sensitivity and very low detection limits. In addition, bacterial detection methods must also offer extremely high selectivity, as a very small number of pathogenic bacteria often coexist with numerous other non-pathogenic micro-organisms. Conventional bacterial detection methods are often based on culture and enumeration, which takes a very long time to obtain results. The PCR method, although rapid, is very costly. Biosensors represent a new alternative for rapid, selective detection of bacteria at very low thresholds. They combine a bioreceptor that selectively recognizes the desired bacteria with a transducer that transforms the interaction between the bioreceptor and the bacteria into a measurable signal.

The proposed project involves the development of biosensors for bacterial detection, with a detection system featuring rapid fluorescence readout based on a "mix and detect"(1) approach. The transducers to be developed will be based on organic nanomaterials based on graphene quantum dots modified by macromolecules that enable off/on fluorescence following the FRET phenomenon. The nanomaterials will be modified with bioreceptors known to interact selectively with bacterial surface proteins (2). Synthesis and chemical modification will be carried out at ICMMO under the responsibility of Dr. Hafsa Korri-Youssoufi, while fluorescence characterization will be carried out at the ISMO laboratory under the responsibility of Prof. Rachel Méallet (3).

References  
(1)Antimicrobial Activity of Cationic Poly(3-hexylthiophene) Nanoparticles Coupled with Dual Fluorescent and Electrochemical Sensing: Theragnostic Prospect, Nada Elgiddawy , Shiwei Ren, Wadih Ghattas, Waleed M. A. El Rouby, Ahmed O. El-Gendy, Ahmed A. Farghali, Abderrahim Yassar and Hafsa Korri-Youssoufi, Sensors 2021, 21, 1715 Sensors 2021, 21, 1715  
(2)Dispersible Conjugated Polymer Nanoparticles as Biointerface Materials for Label-Free Bacteria Detection, Nada Elgiddawy, Shiwei Ren, Abderrahim Yassar, Alain Louis-Joseph, Hélène Sauriat-Dorizon, Waleed M.A. El Rouby, Ahmed O. El-Gendy, Ahmed A. Farghali, and Hafsa Korri-Youssoufi, ACS Appl. Mater. Interfaces 2020, 12, 36, 39979–39990  
(3) Luminescence-Sensitive Surfaces Bearing Ratiometric Nanoparticles for Bacteria Growth Detection, Miaobo Pan, Gabriela Morán Cruz, Chloé Grazon, Djamila Kechkeche, Ludivine Houel Renault, Gilles Clavier, and Rachel Méallet-Renault, ACS Applied Polymer Materials 2022 4 (8), 5482-5492

**Mission**

-Synthesis and characterization of fluorescent nanomaterials

-Functionalization with bioreceptor

-Study the optical and photo-physical properties of the nanomaterials.

-Detection of a non-pathogenic model bacterium by measuring the variation in fluorescence. -Detection properties by measuring sensitivity selectivity and reproducibility.

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