

## PhD candidates

### Science and Technology of Quantum Semiconductor Biosensors

NSERC and Canadian Industry supported Strategic Project between:

Université de Sherbrooke (UdeS)

Faculty of Engineering

Department of Electrical and Computer Engineering

**Interdisciplinary Institute for Technological Innovation (3IT)**

Quantum Semiconductors and Photon-based BioNanotechnology (QS Group, Prof. J.J. Dubowski)

SHERBROOKE, QC J1K 0A5

Université de Sherbrooke

Faculty of Medicine

Department of Microbiology and Infectiology (Prof. E.H. Frost)

SHERBROOKE, QC J1H 5N4

Carleton University

Faculty of Science

Department of Chemistry (Prof. M. DeRosa)

OTTAWA, ON K1S 5B6

The QS Group has been collaborating with Canadian companies interested in acquiring a wining technology for automated monitoring of water reservoirs for the presence of pathogenic bacteria. The application of **quantum semiconductors** (QS) in this area has been attractive due to the sensitivity of these materials to electrically charged molecules, such as bacteria and viruses that can be immobilized on their surfaces. These characteristics, in addition to the potential of delivering automated and low-cost biosensing have resulted in the growing interest in the QS technology (patent pending).

Applications are invited for the following projects:

#### 1. Mechanisms of formation of alkanethiol self-assembled monolayers on photocorroding surfaces of III-V semiconductors

This project is offered to a **physics or electrical engineering** MSc student. In either case, the ideal candidate will have a good knowledge of solid-state physics and/or semiconductor physics. Basic knowledge of organic chemistry and technology of self-assembled monolayers (SAMs) would be assets. The goal of the project is to advance knowledge of SAM formation on GaAs for enhanced/optimized capture of bacterial antibodies. The candidate will be responsible for the development of a device for monitoring the photocorrosion process of GaAs/AlGaAs nano-heterostructures and characterisation of fabricated SAMs using optical (FTIR absorption), physical (AFM) and chemical (XPS) characterization methods. Some experience in data collection and analysis is required. The candidate will be supervised by Prof. J.J. Dubowski (Canada Research Chair in Quantum Semiconductors) and he/she will collaborate with a biotechnologist and a post-doctoral fellow specializing in physics and chemistry of surfaces.

## **2. Investigation of antibody capture efficiency of bacteria on biofunctionalized surfaces of GaAs**

This project is offered to a **biology or microbiology** MSc student. The ideal candidate will have good knowledge of immunology and microbiology with a particular emphasis on the interaction between antibodies and their antigens. Basic knowledge of growing bacteria in a level 2 facility, chemical modification of antibodies, and experience in fluorescence microscopy would be assets. The goal of the project is to advance knowledge of efficient antibody use for biosensor applications, specifically those concerning using antibodies to capture *Legionella pneumophila*. The candidate will be co-supervised by Prof. E.H. Frost and Prof. Dubowski and he/she will collaborate with a biochemist and a post-doctoral fellow specializing in designing and developing advanced strategies for fabrication of antibodies.

## **3. Innovative polymer-based architectures for enhanced performance immunosensors**

This project is offered to a **chemistry or biochemistry** MSc student. The ideal candidate will have a good foundation in polymer synthesis and bioconjugation techniques. Experience in the preparation and modification of polymer brushes is preferred. Experience with self-assembled monolayers, microbiology, and antibodies and other molecular recognition agents are assets. Basic knowledge of polymer and surface characterization techniques are required. In particular, the candidate will be responsible for developing “grafted from” and “grafted to” polymer brush systems for improving the density and orientation of *Legionella* antibodies on GaAs surfaces. The candidate will be co-supervised by Prof. DeRosa and Prof. Dubowski and he/she will work closely with other team members specializing in the surface chemistry, physics, and microbiology.

Start: May 1<sup>st</sup>, 2017

Salary: CDN\$19,000/year

To apply for these positions, please send applications (a cover letter and CV) to Prof. J.J. Dubowski, [jan.j.dubowski@usherbrooke.ca](mailto:jan.j.dubowski@usherbrooke.ca), or through our website: <http://www.dubowski.ca>.