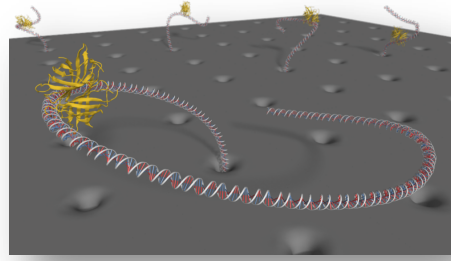


## Summer 2012 - Physics Research Projects



The "Applied Single-Molecule Biophysics Group" ([www.tcoosalab.net](http://www.tcoosalab.net)) is dedicated to the development of novel techniques and methods to manipulate and characterize single-molecules using nanofluidic devices, to unravel the basic physics governing the behaviour of biological molecules in nanoconfined geometries, and ultimately to translate these discoveries into new tools for the life sciences. As part of this new research program at the University of Ottawa, multiple interdisciplinary experimental projects are being initiated. The T.-Cossa laboratory is located in the recently renovated state-of-the-art Center for Interdisciplinary NanoPhysics, in the basement of MacDonald Hall - see the Infrastructure page at [www.biophysics.uottawa.ca](http://www.biophysics.uottawa.ca)

### Project #1 – *Single-Molecule Fluorescence and Electrical Detection through Nanopores:*

A student will assist during the operation of a unique instrument capable of simultaneous fluorescence and electrical detection of individual biomolecules passing through nanometer-scaled solid-state pores – nanopores are nanometer-scale holes in thin insulating membranes (e.g. 30nm thick silicon nitride) whose architecture provides spatial confinement for capture and subsequent manipulation and/or interrogation of single molecules. Such tool can be used to optically track single molecule motion in confined geometries, or single molecule bond dissociation for force spectroscopy applications.

### Project #2 – *Nanofluidic Transistor:*

In collaboration with Stanford University, a student will test field-effect gated nanopore devices to study de-screening effects under high electric fields. A gated nanopore is a nanometer-scale hole in a thin insulating membrane equipped with an embedded metal nanoelectrode. When immersed in a liquid electrolyte, the applied bias at the gate will be used to modulate the ionic current flowing through the channel (hence the transistor analogy). Ultimately such nanofluidic devices will be used to detect and manipulate biological molecules, specifically for nanopore-based DNA sequencing applications.

### Project #3 – *Solid-state Nanopore-based Force Spectroscopy (NFS):*

Solid-state nanopores can be used to probe the strength of biological bonds, much like AFM or optical tweezers, but with increased simplicity, parallelizability and speed. NFS employs the electric field inside the pore to pull on charge molecules (DNA, RNA, proteins). As student will use this technique to map aptamer-protein energy landscapes and apply his results to the selection of aptamers against specific proteins.

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