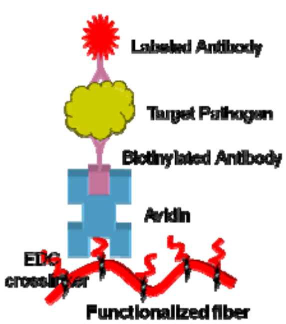
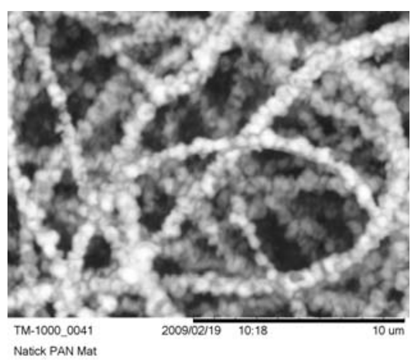
**Functional Nanofibrous Membrane Assemblies towards Biological Sensing**

Our research focuses on developing electrospun platforms capable for use in diagnostics to both capture and detect biomolecules from complex matrices, such as food and environmental samples. The electrospinning process produces high surface area nanofibrous membranes that can be tailored to operate as either an electrochemical or optical sensor. Adding functional groups (amines or carboxyl groups) to either the electrospinning process (for optical) or during the deposition of the conductive polymer to the membrane (electrochemical) provides the source for covalent attachment of biomolecular recognition elements (antibodies, peptides/DNA) to the membrane. This allows for the selective binding/capture of target biological agents using the electrospinning fabrication technique. These functionalized electrospun membranes do not require flow devices or pumps that will allow for the development of smaller biosensor foot prints. A carboxylated electrospun polymer was used to produce nanofibrous membranes functionalized with Staphylococcal enterotoxin B (SEB) antibodies and demonstrated that it could detect 0.5 ng/ml concentration of toxin using a simple laboratory luminometer to measure a chemiluminescent signal. Conductive or semi-conductive electrospun nanofibrous membranes were developed based on the need to promote molecular recognition attachment. Various conductive polymer coating approaches were investigated to enhance conductivity of the membranes in an effort to provide maximum conductivity for charge transfer. The pyrrole and thiophene monomers (pyrrole 3-carboxylic acid and 3-thiophene acetic acid) were chosen to supply carboxylic acid functional groups for attachment of biomolecular recognition elements. Research into modeling dimers of pyrrole and functional thiophene monomer combinations showed trans confirmation, increase planarity, and charge mobility in the model dimer molecule. Dimer reorganization energy (a.k.a. distortion energy) calculated was: Bipyrrole 0.581 eV, Pyrrole-3CCOOH thiophene 0.509 eV, Pyrrole-3COOH thiophene 0.342 eV and Pyrrole-3COOH thiophene 0.342 eV. Future work on conductive nanofibrous membranes will consists of coating the nanofibers with a conformal conductive functional (NH2, COOH, Oxides) coating to allow for biological molecule attachment. This work will be done in collaboration with MIT/ISN using the oCVD process (oxidative Chemical Vapor Deposition) and North Carolina State using Atomic Layer Deposition (ALD).




Pedot-coated polyacrylanitrile

Senecal A., J. Magnone, P. Marek and K. Senecal. 2008. Development of functional nanofibrous membrane assemblies towards biological sensing. *Reactive & Functional Polymers* 68:1429-1434.

Sreeram Vaddiraju, Kris Senecal, Karen K. Gleason. 2008. **“**Novel Strategies for the Deposition of —COOH Functionalized Conducting Copolymer Films and the Assembly of Inorganic Nanoparticles on Conducting Polymer Platforms,” *Advanced Functional Materials* Volume 18, Issue 13: 1929-1938.

**Patents or other steps toward commercialization:** Patent application submitted: “Nanofibrous Membrane Technology for use in Enhanced Chem/Bio Capture,” K. Senecal, A. Senecal, P. Pivarnik, C. Mello, J. Soares and H. Schreuder-Gibson. #20060148066.