

# Nanoscale Architecture and Control of Biofilm Based Micro-Electronic Biosensors for Biological and Chemical Agents



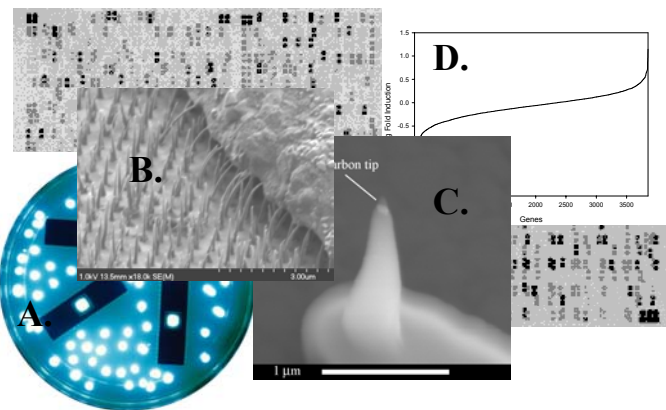
Gary S. Saylor<sup>a</sup> and Michael L. Simpson<sup>b</sup>  
<sup>a</sup>University of Tennessee Center for Environmental Biotechnology and <sup>b</sup>the Oak Ridge National Laboratory  
 676 Dabney Hall  
 Knoxville, Tennessee 37996-1605  
 Ph: 865-974-8080 Fax: 865-974-8086  
<sup>a</sup>saylor@utk.edu <sup>b</sup>simpson ML1@ornl.gov



## PROJECT GOALS AND OVERVIEW

Bio-agent biosensors constructed from tailored microbial biofilms grown on a silicon chip surfaces, spatially localized and instrumented by carbon nanofiber artificial membranes.

## LAB ACCOMPLISHMENTS



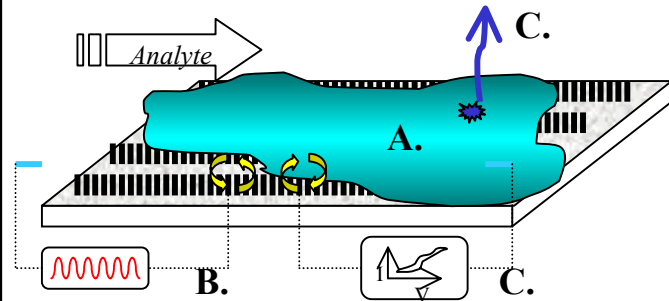
Deployment of GMO as components in engineered systems

- A. Whole-cell biosensors (Bioluminescent Bioreporter Integrated Circuit (BBIC))
- B. Carbon nanofiber arrays for molecular-scale interface to biofilm communities
- C. Nanoscale electrochemical probes
- D. Electrically-inducible promoters

## NOTES

On exposure to a chemical or biological agents, a cascade of molecular events is generated that results in a pattern of electrochemical and photonic responses.

## ENVISIONED DELIVERABLE



Development of GMO in biofilms as complex components in engineered biosensing systems

- A. Biofilms grown on nanostructured substrates
- B. Excitation delivery into genetic circuits via carbon nanofibers and electrically-inducible promoters
- C. Measurement of biofilm response by nanoscale electrochemical probes and bioluminescence

## PROJECTED MILESTONES (NEXT 12 MONTHS)

- electrical current induction of model prokaryotic genomes, *E. coli* and *B. subtilis*.
- carbon nanofiber (CNF) electrode array for excitation delivery into microbial biofilms.
- current-controlled gene expression in biofilm using CNF electrodes
- analyze the electrically modulated gene expression response of an *E. coli* biofilm to surrogate bioagents
- determine electrochemical potentials to be measured as output signals from microbial biofilms.