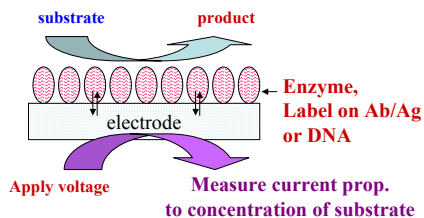


**DESIGNING ELECTROCHEMICAL
SENSORS BASED ON ULTRATHIN
BIOMOLECULAR FILMS
AND NANO-MATERIALS**

James F. Rusling
Departments of Chemistry & Pharmacology
University of Connecticut
Storrs, CT USA



Electrochemical Biosensors



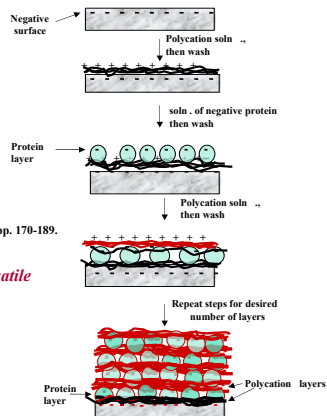
- nanoscale biosensing architecture
- patternable nanomaterials for arrays

**Layer-by-layer
Film assembly**

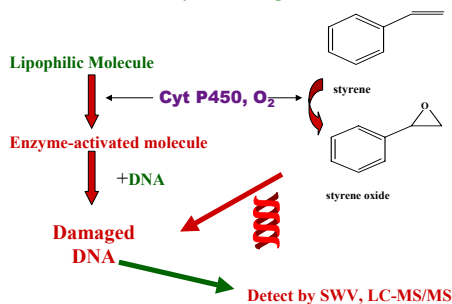
Lvov, Decher

Lvov, Y. in Nalwa, R.W.; Ed.;
*Handbook Of Surfaces And Interfaces
Of Materials, Vol. 3.* Academic, 2001, pp. 170-189.

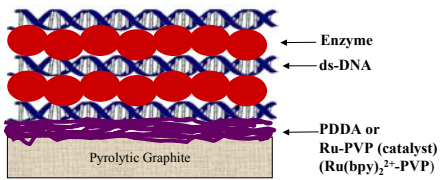
Stable, easily prepared, versatile



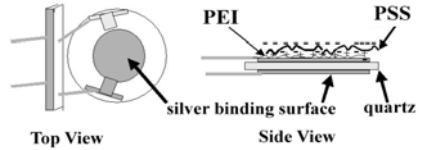
Toxicity Screening



Films for Toxicity Screening

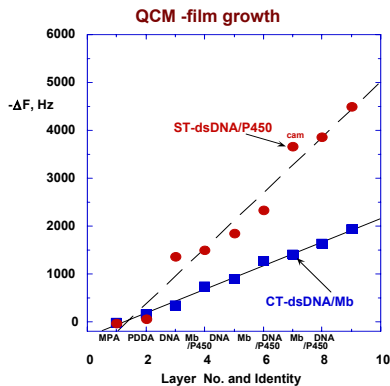


QCM Resonator



$$\text{Mass: } M/A = -\Delta F / 1.86 \times 10^8$$

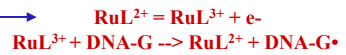
$$\text{Thickness: } d = -(0.016) \Delta F$$

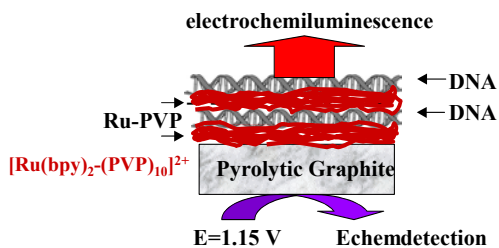
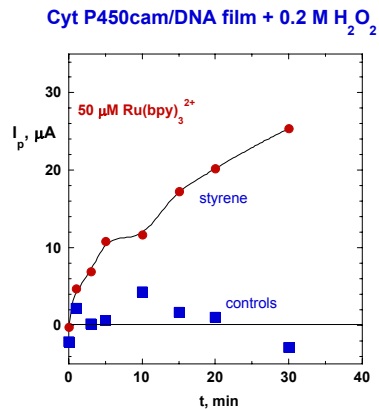
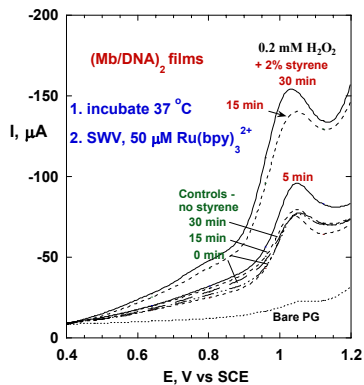


Screening Chemical Toxicity

Enzyme reaction:
Incubate film with
Metabolite + H₂O₂

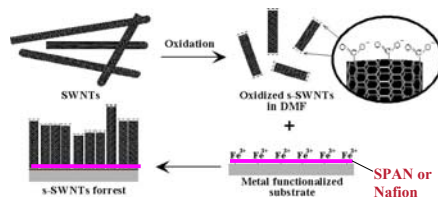
Analysis by catalytic SWV or
electrochemiluminescence



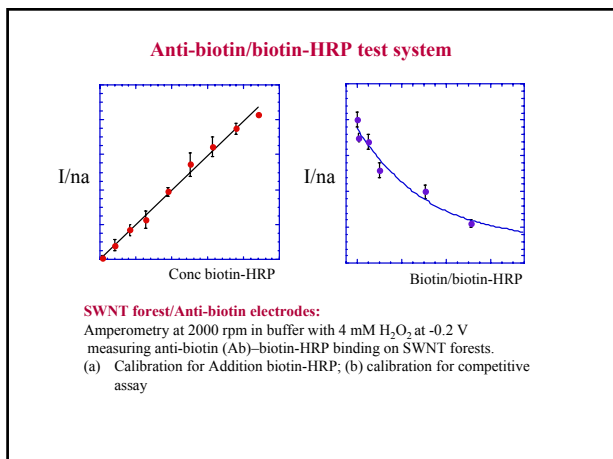
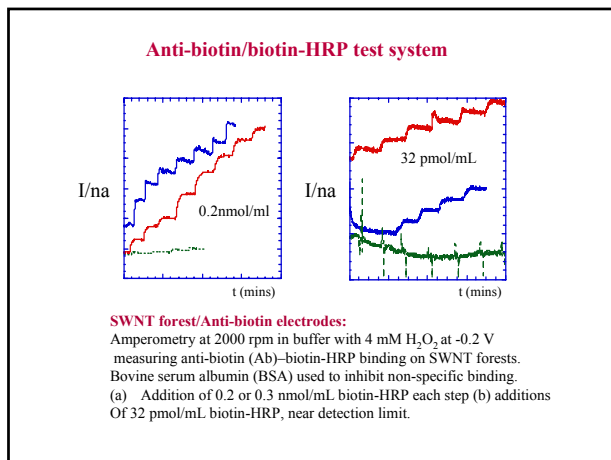
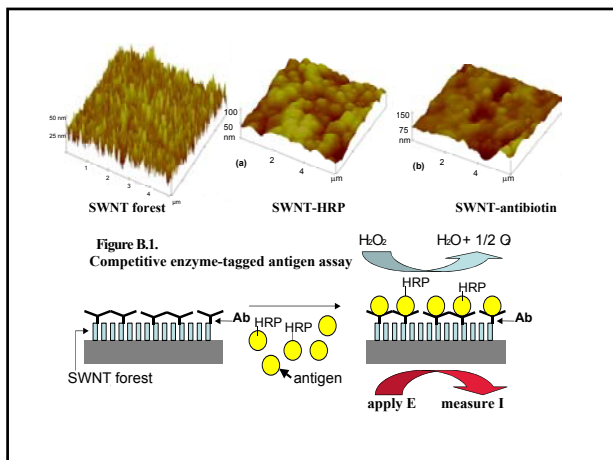


Lynn Dennany, Robert J. Forster and James F. Rusling,
 "Simultaneous Direct Electrochemiluminescence and Catalytic
 Voltammetry Detection of DNA in Ultrathin Films"
J. Am. Chem. Soc. 2003, 125, 5213-5218.
 Collaboration with NCSR, Dublin City Univ.

Single-Walled Carbon Nanotube Forests: Antigen-Antibody Sensing



Chattopadhyay, Galeska, Papadimitrakopoulos, *J. Am. Chem. Soc.* 2001, 123, 9451.
 End COOH groups allow chemical attachment to proteins (antibodies)



- Design approaches to future arrays**
1. Layer by layer approach general, simple
 2. Stable films, complex architecture, any surface
 3. Ambient T solution processable
 4. SWNT forests patternable by solution process
 5. Possibility of automation
 6. Sensors for toxicity, oxidative stress, proteins, pathogens
 7. Enhancement of sensitivity by electrochemical catalysis or conducting polymers

Thanks to NIH, NSF, ARO for funding!

Thanks to all our coworkers and collaborators

<http://sp.uconn.edu/~rusling/>

Thanks to YOU for listening!

Thanks to intangible creative factors



+

