Designing Electrochemical Sensors based on Ultrathin Biomolecular Films and Nano-materials

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Electrochemical Biosensors

- Enzyme, Label on Ab/Ag or DNA
- Apply voltage
- Measure current prop. to concentration of substrate

- nanoscale biosensing architecture
- patternable nanomaterials for arrays

Layer-by-layer Film assembly
Lvov, Decher

Stable, easily prepared, versatile

Toxicity Screening
Lipophilic Molecule
Cyt P450, O₂
Enzyme-activated molecule +DNA
Damaged DNA
Detect by SWV, LC-MS/MS
Films for Toxicity Screening

QCM Resonator

Screening Chemical Toxicity

Enzyme reaction: Incubate film with Metabolite + \text{H}_2\text{O}_2.

Analysis by catalytic SWV or electrochemiluminescence

\[ \text{RuL}_2^+ = \text{RuL}_3^+ + e^- \]
\[ \text{RuL}_3^+ + \text{DNA-G} \rightarrow \text{RuL}_2^+ + \text{DNA-G}^* \]

Collaboration with NCSR, Dublin City Univ.


End COOH groups allow chemical attachment to proteins (antibodies)
Figure B.1. Competitive enzyme-tagged antigen assay

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
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Thanks to YOU for listening!

Thanks to intangible creative factors

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