

Micro-Nano-Bio Systems for Biological Applications

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**THIRTY YEARS OF
SYSTEMS RESEARCH
EXCELLENCE**

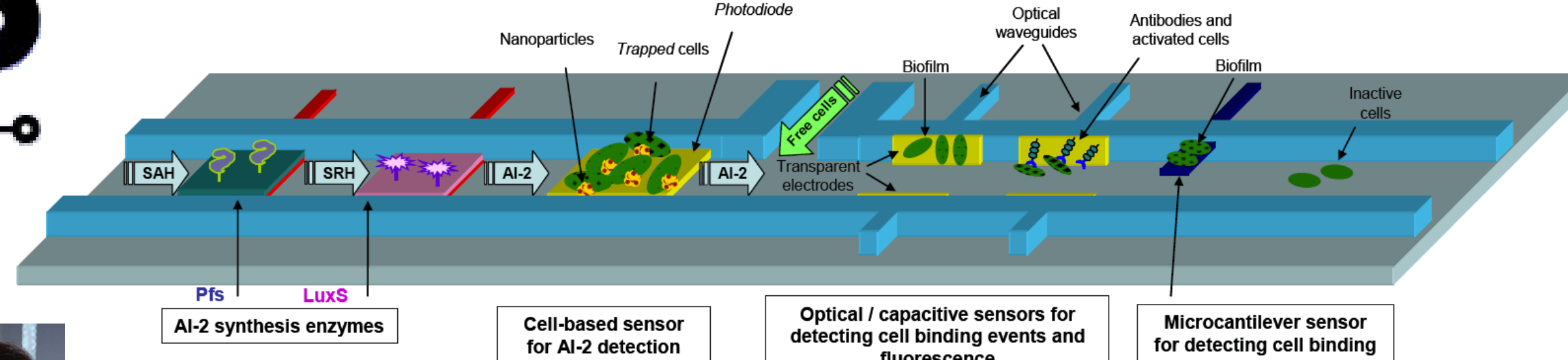
UNIVERSITY OF MARYLAND
INSTITUTE FOR SYSTEMS RESEARCH
A. JAMES CLARK SCHOOL OF ENGINEERING

History

THE MARYLAND
biochip
COLLABORATIVE



Goal: to enlist molecular bioengineering to translate the communication between biological and microfabricated systems in a manner that embraces the fragility of biology



Biochip concept: MEMS-based reconstruction of the AI-2 biosynthetic pathway

Specifically, to interface the biological elements of the bacterial quorum sensing circuitry – responsible for formation of difficult-to-treat bacterial *biofilms* – with MEMS

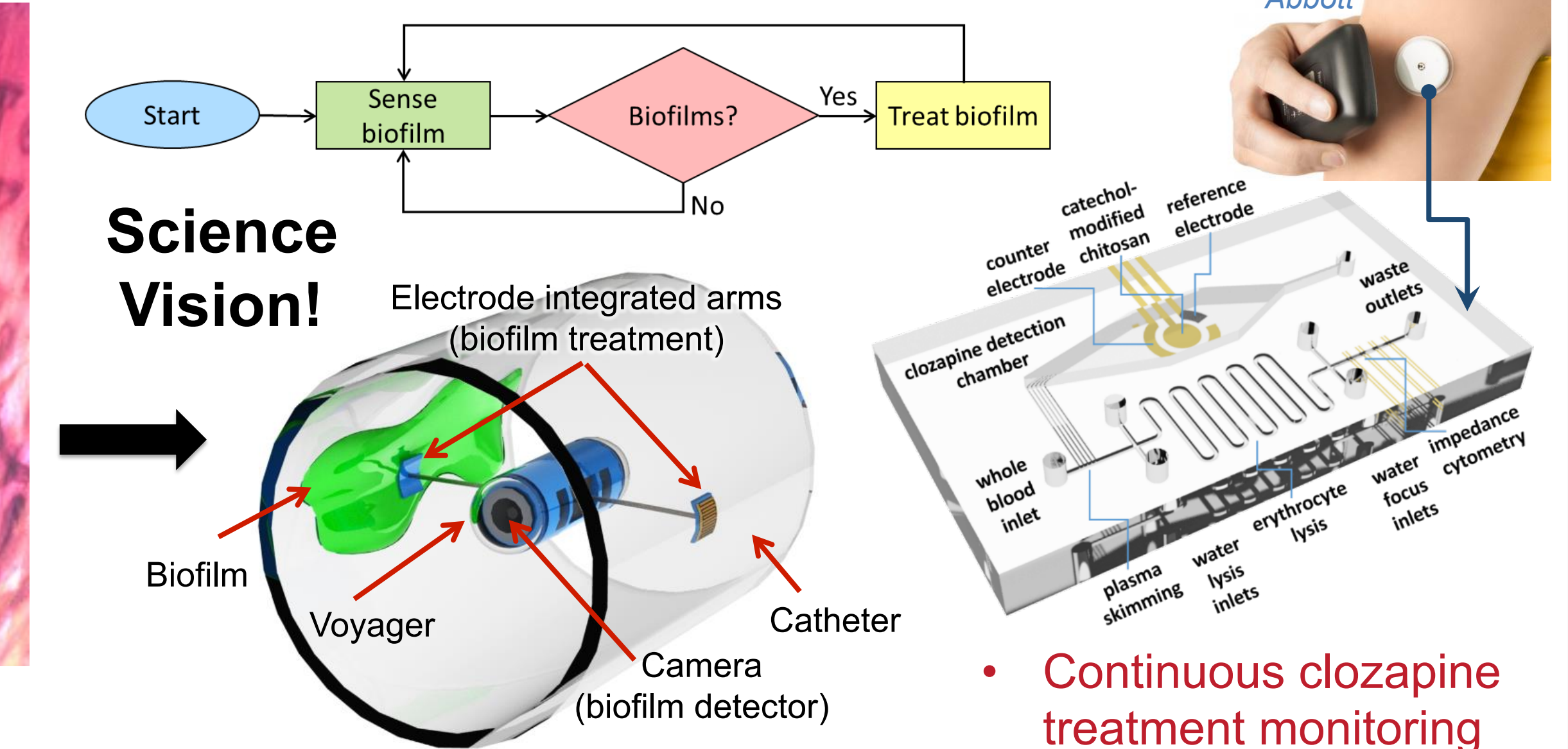
Future

Science Fiction?



Fantastic Voyage, 1966, 20th Century Fox

- Autonomous biofilm detection and treatment

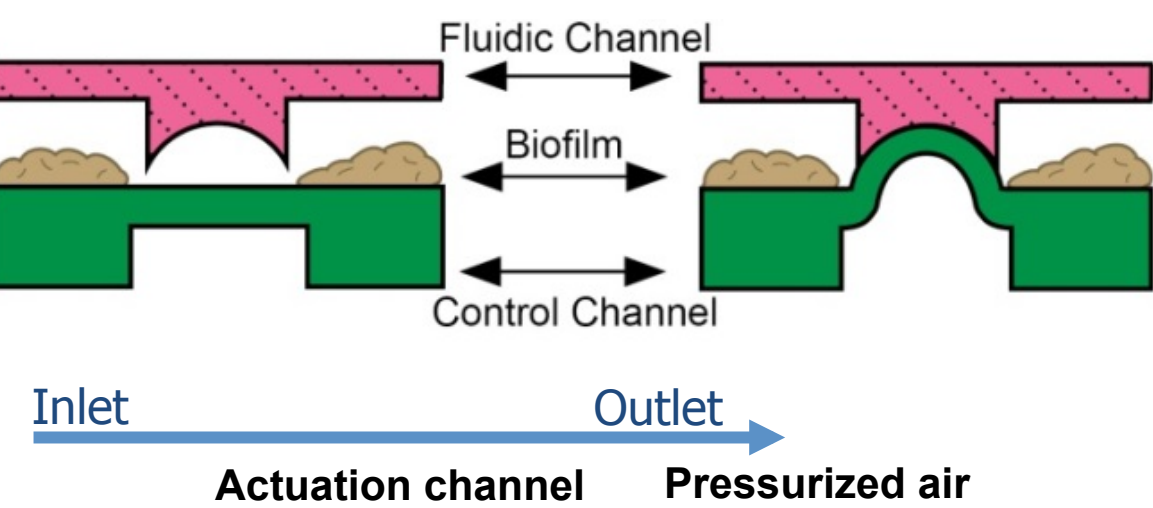


- Continuous clozapine treatment monitoring

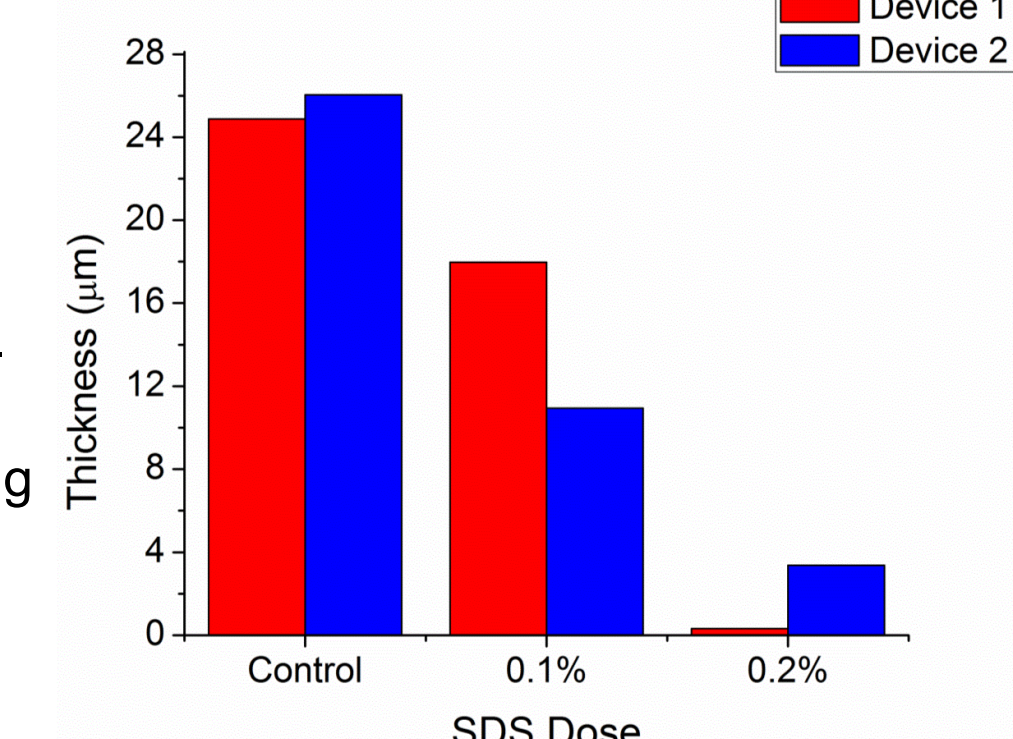
Current

μTAS for Biofilm Studies

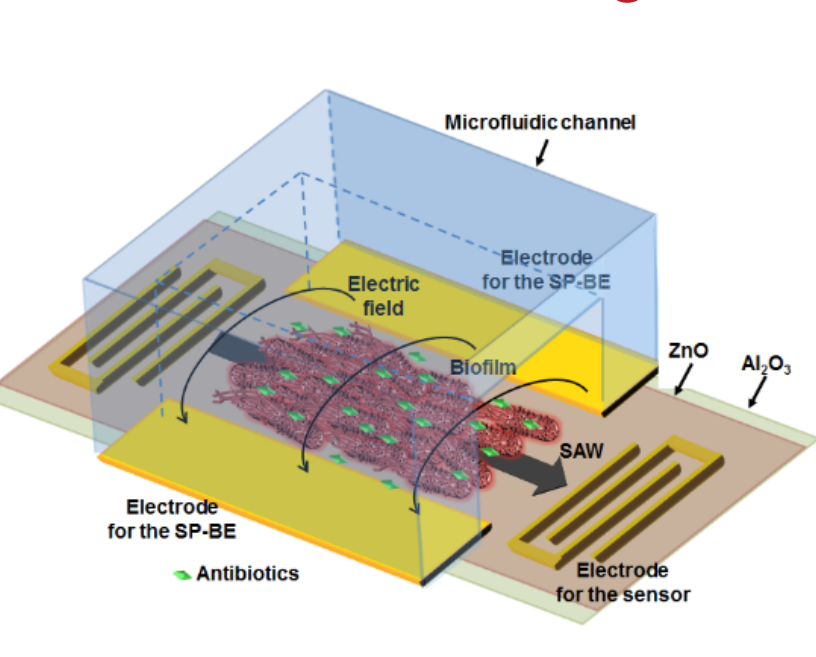
- Biofilm Sectioning
- Microsystems enable reliable characterization of biofilm growth and treatment



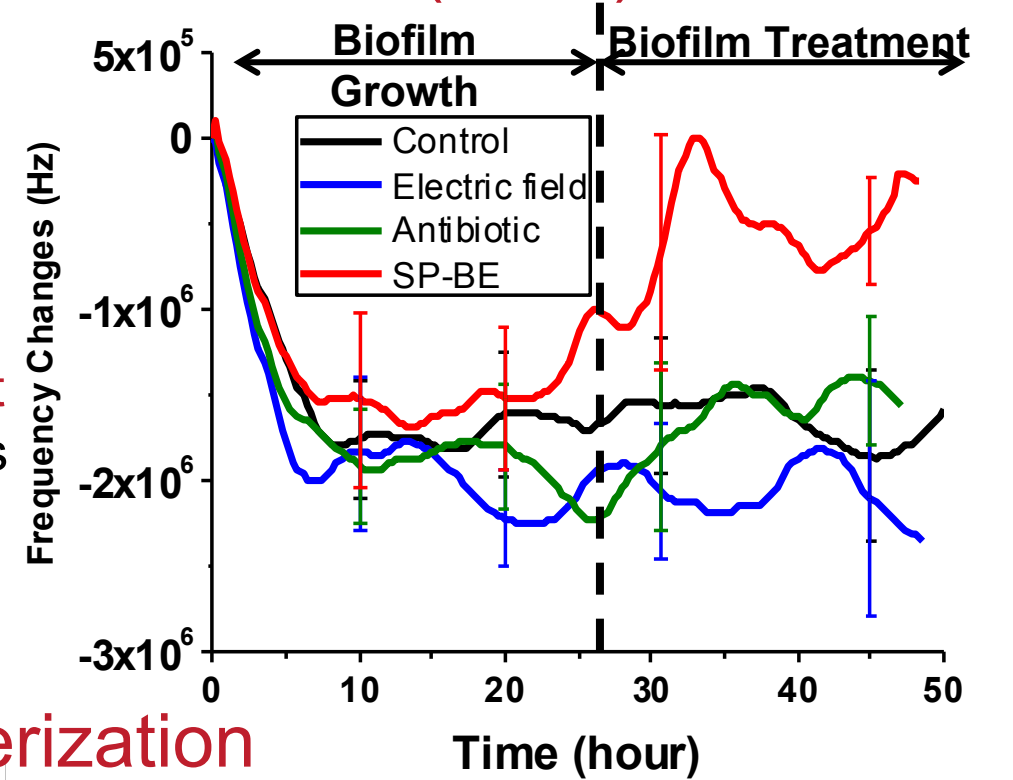
Reliable multi-experiment treatment testing



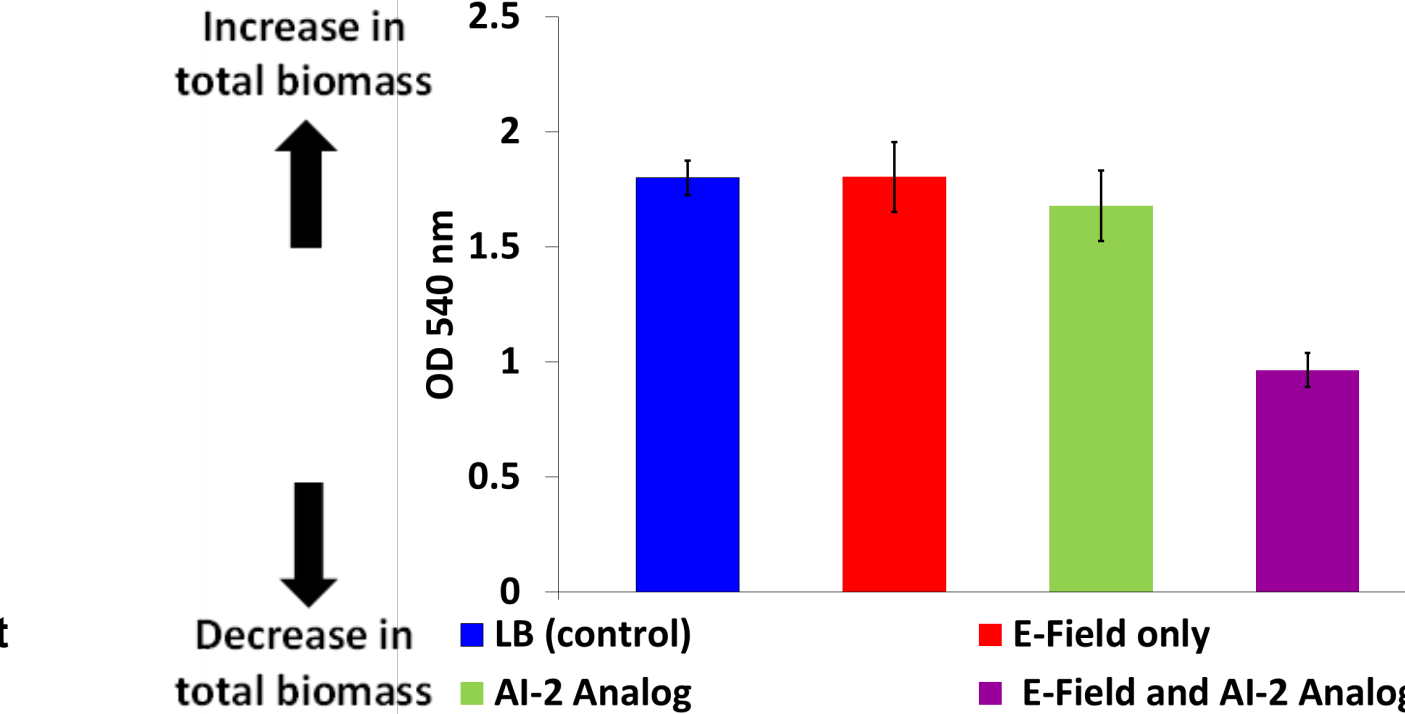
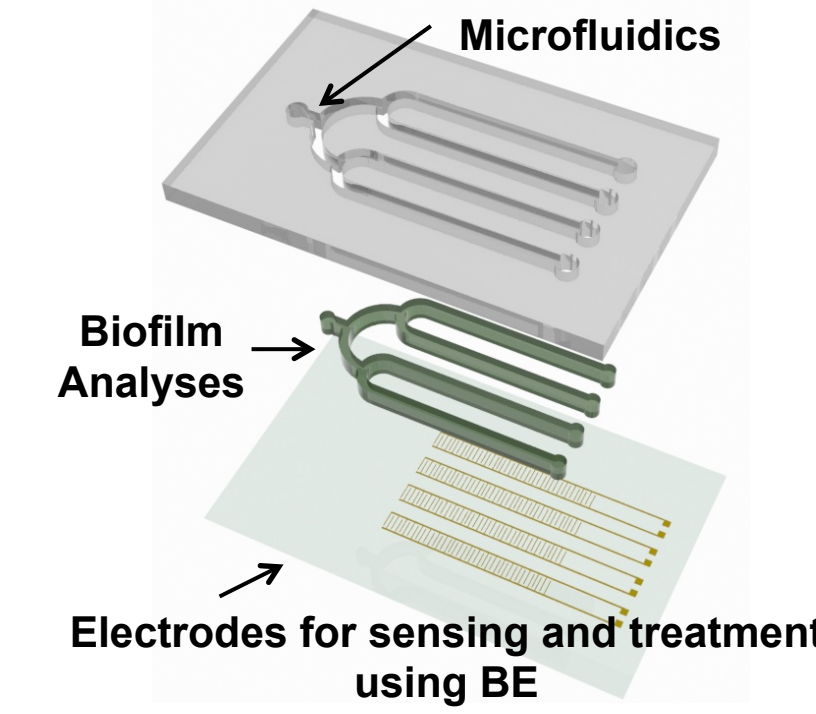
- Treatment-Integrated Surface Acoustic Wave (SAW) Sensor



Real-time monitoring of biofilm growth and treatment
Bioelectric effect treatment results in increased treatment efficacy

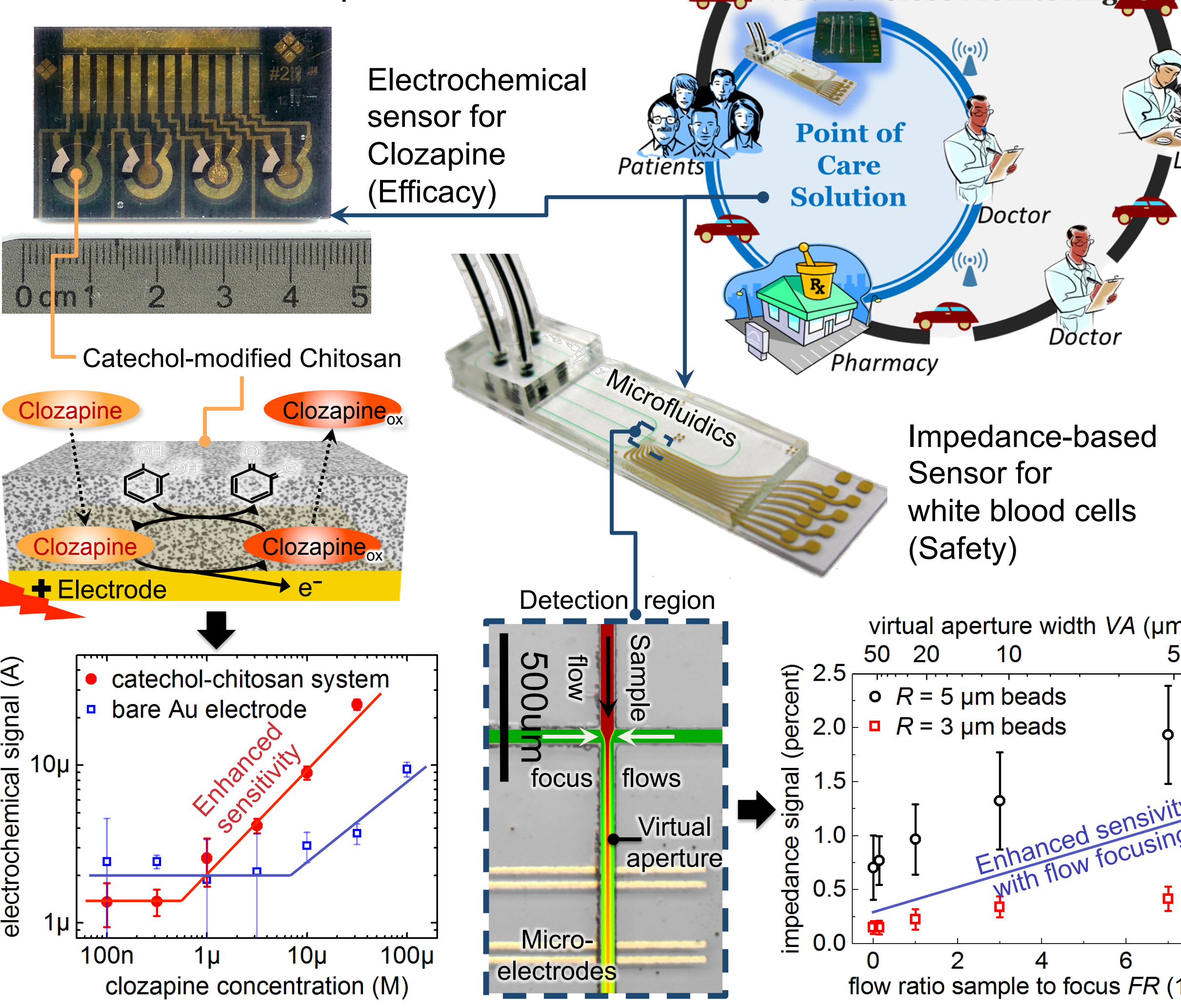


- Combination Treatment Characterization



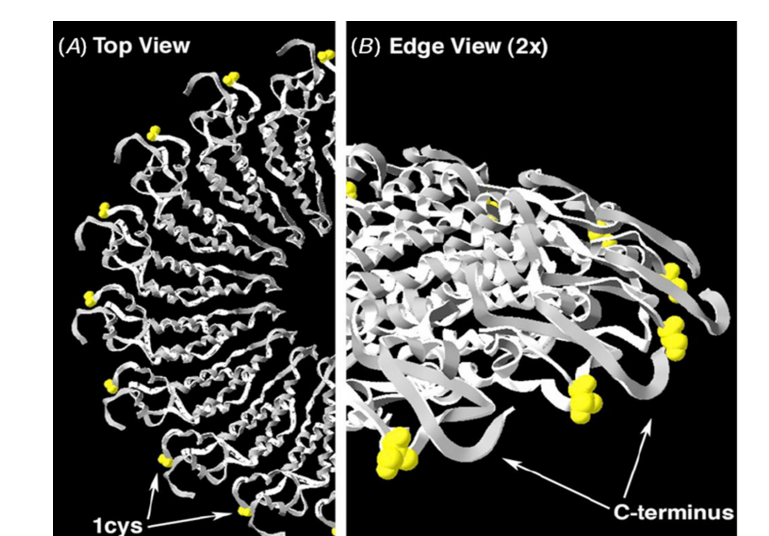
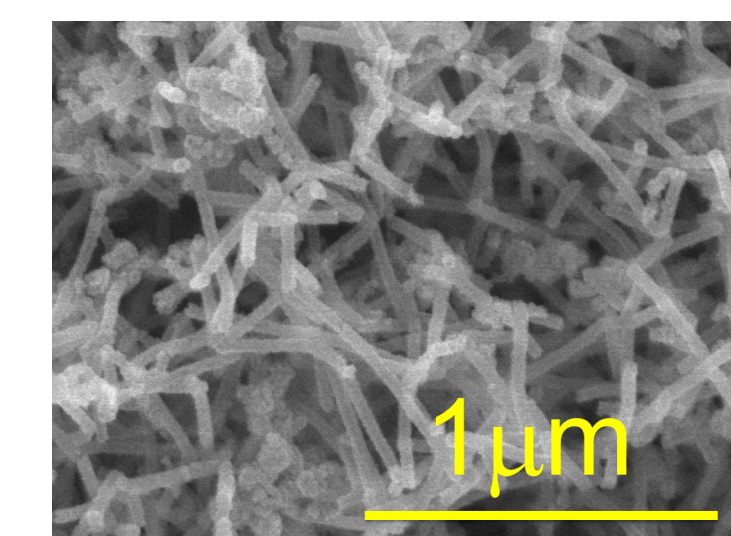
Microsystems Development for Neuropsychiatric Disorders

- Clozapine: highly effective drug for schizophrenia treatment
- Clinical need for **small, portable sensor** to reduce patient burden

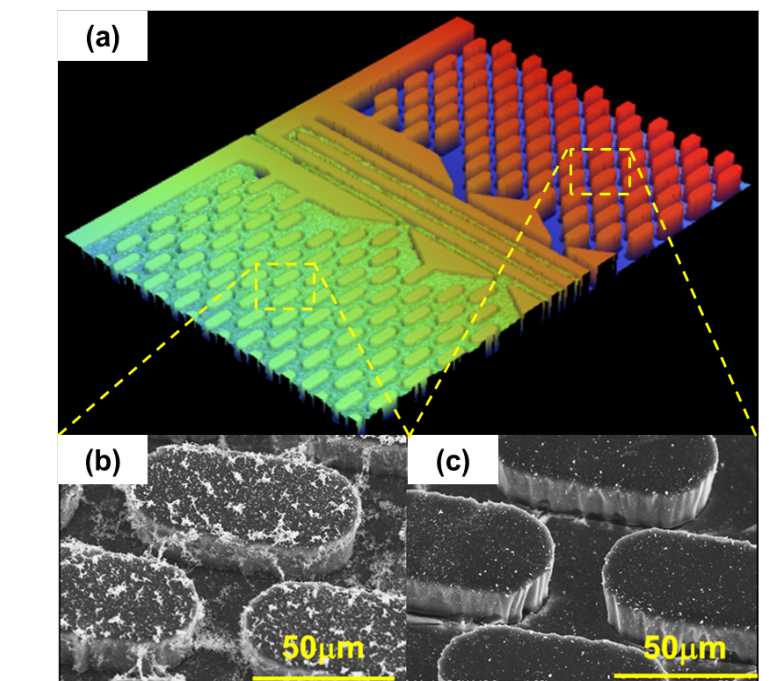
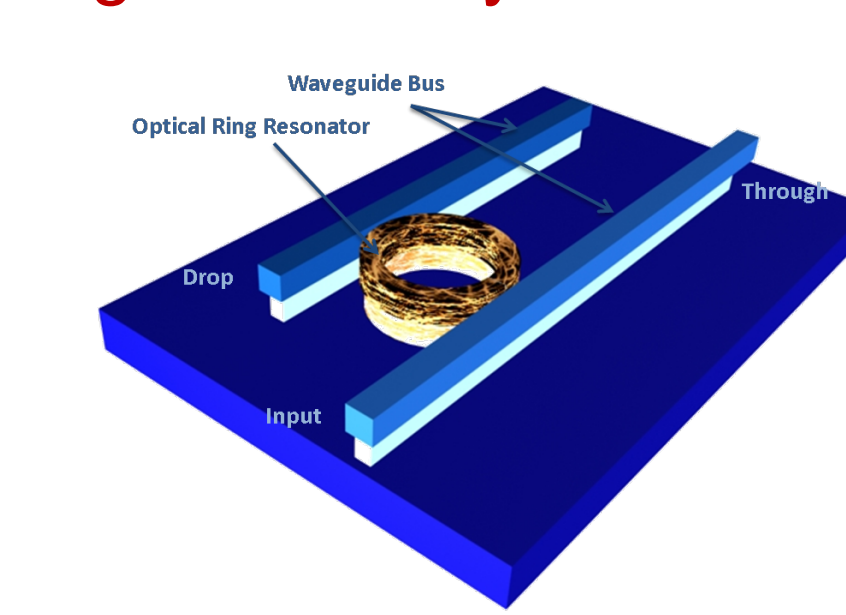


Tobacco Mosaic Virus-like Particles (TMV VLPs)

- TMV/VLP nanorods
- TMV coat proteins



- VLP integrated optical biosensor: combination of high sensitivity and selectivity



- VLP-based TNT sensor

