

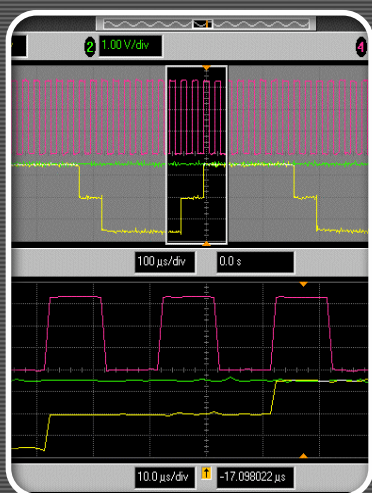
Cell-Based Biosensors for Toxicity Testing of New Chemicals



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Joseph J. Bahl: Sarver Heart Center, UA
Raymond B. Runyan: Cell Biology and Anatomy, UA

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Outline



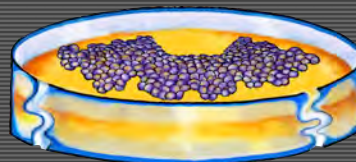
- 1 Motivation
- 2 Environmental Control
- 3 Multi-Sensor Integration
- 4 Cell Attachment

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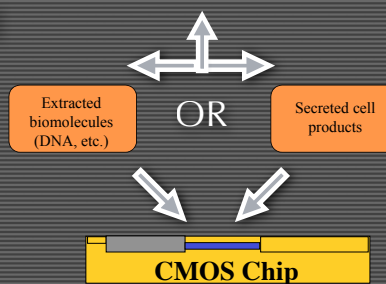
Project Objectives and Impact



- Rapid Assessment of Chemicals and Process Chemistries
- Important for both Chemical and Equipment Suppliers
- A First Step Towards an On-Line ESH Monitor



Reporter cells treated with chemicals of interest

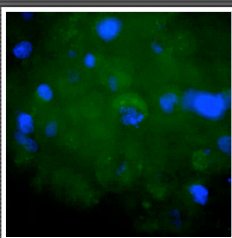


Biosystems of Interest

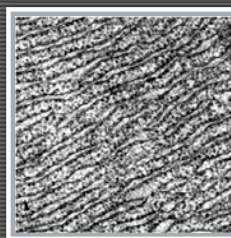
DNA



Cell

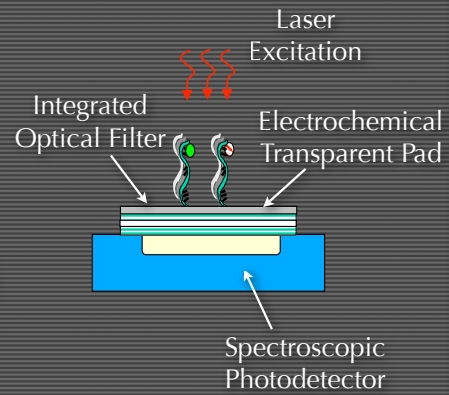


Tissue



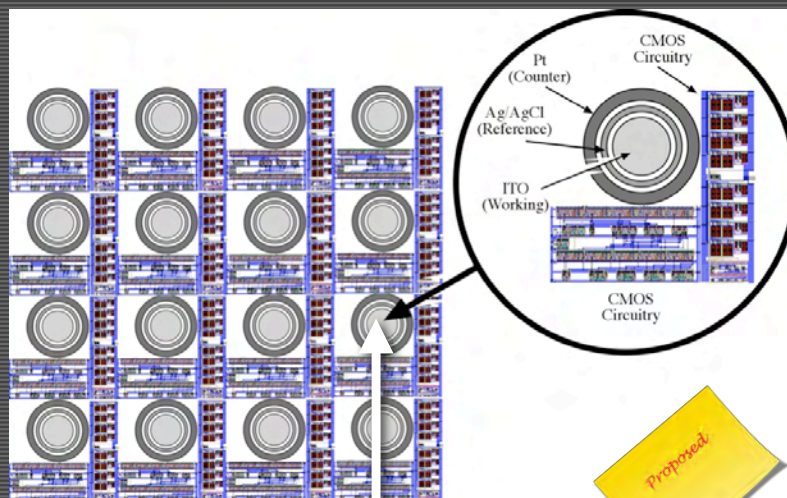
Biosensor Fusion

- 1 Optical Sensing
- 2 Capacitance Sensing
- 3 Electrochemical Sensing
- 4 Electrical Sensors



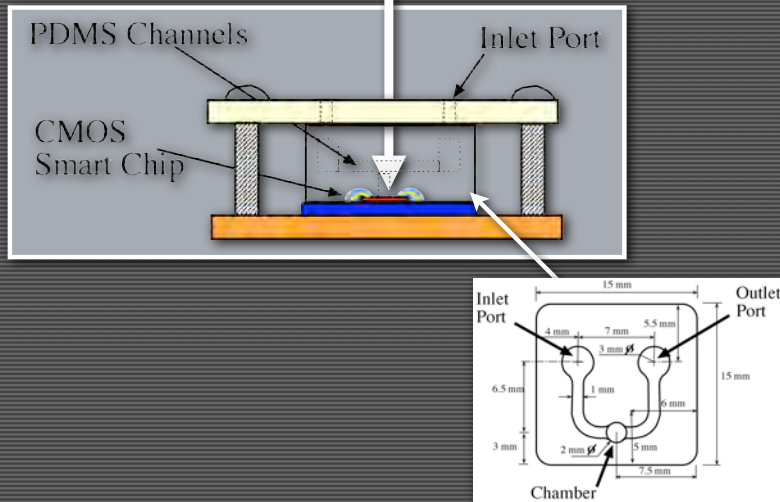
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Biochip Array

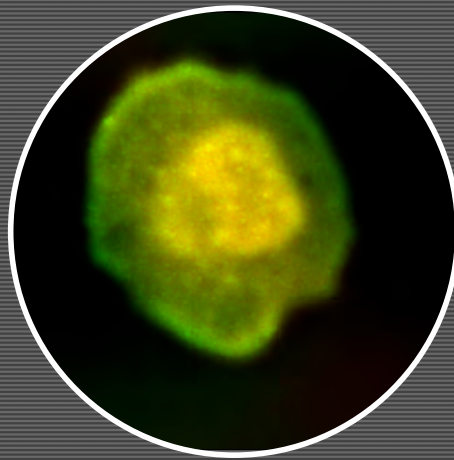


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Biochamber Design



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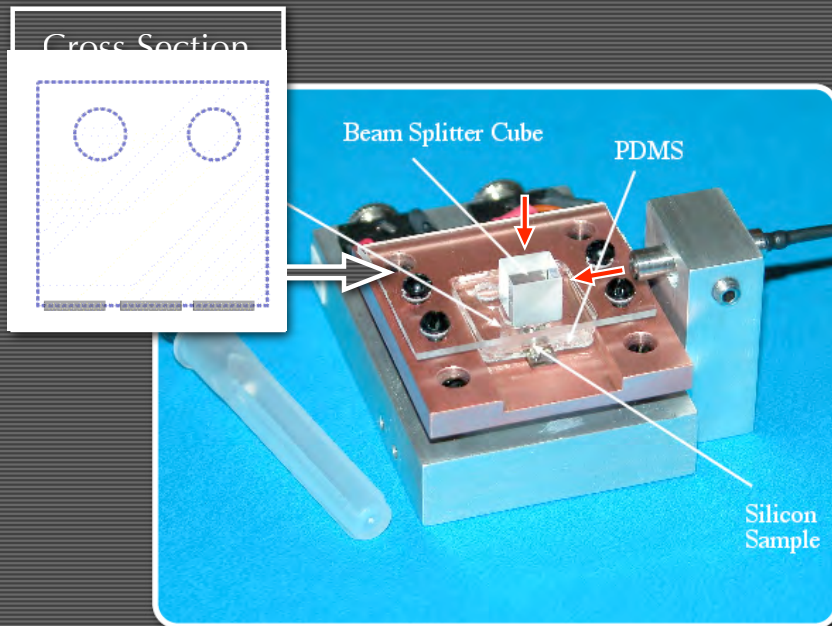


Chamber Supports Cells

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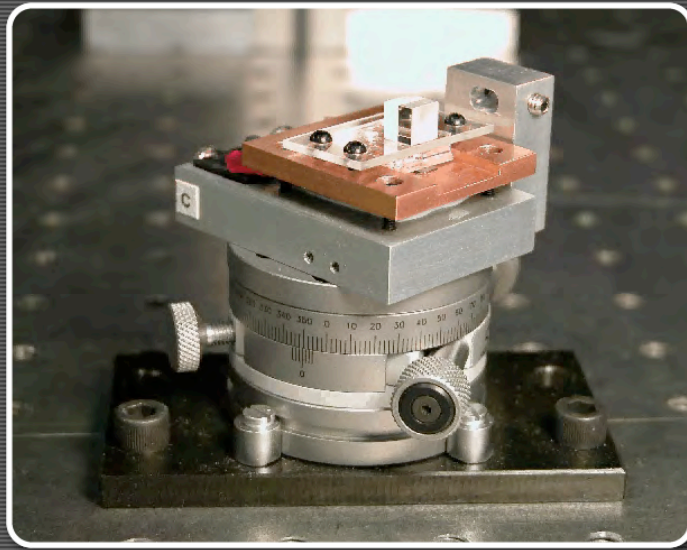
Cell-Based Biosensing

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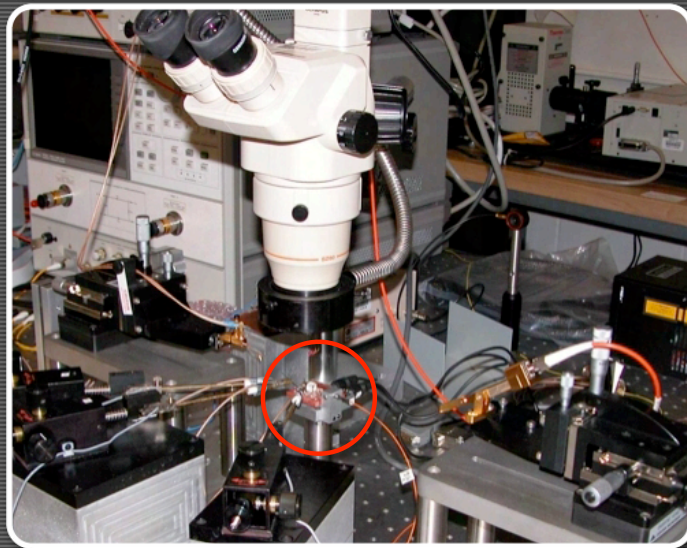
Cell Based Biochamber

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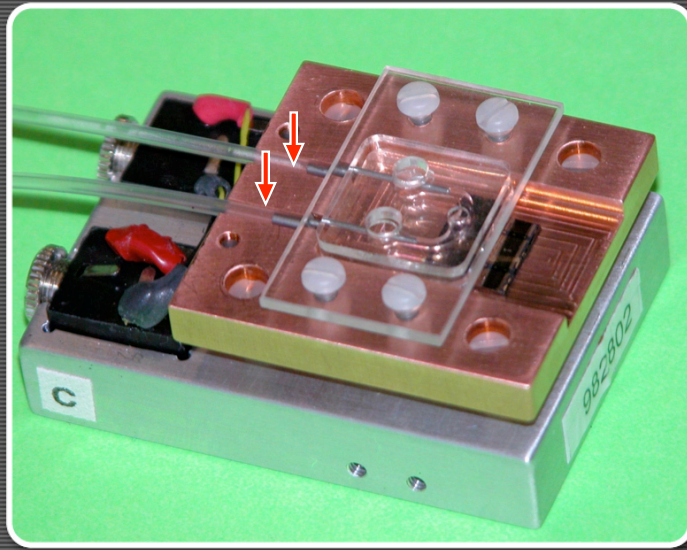
Biochamber

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Biochamber Test

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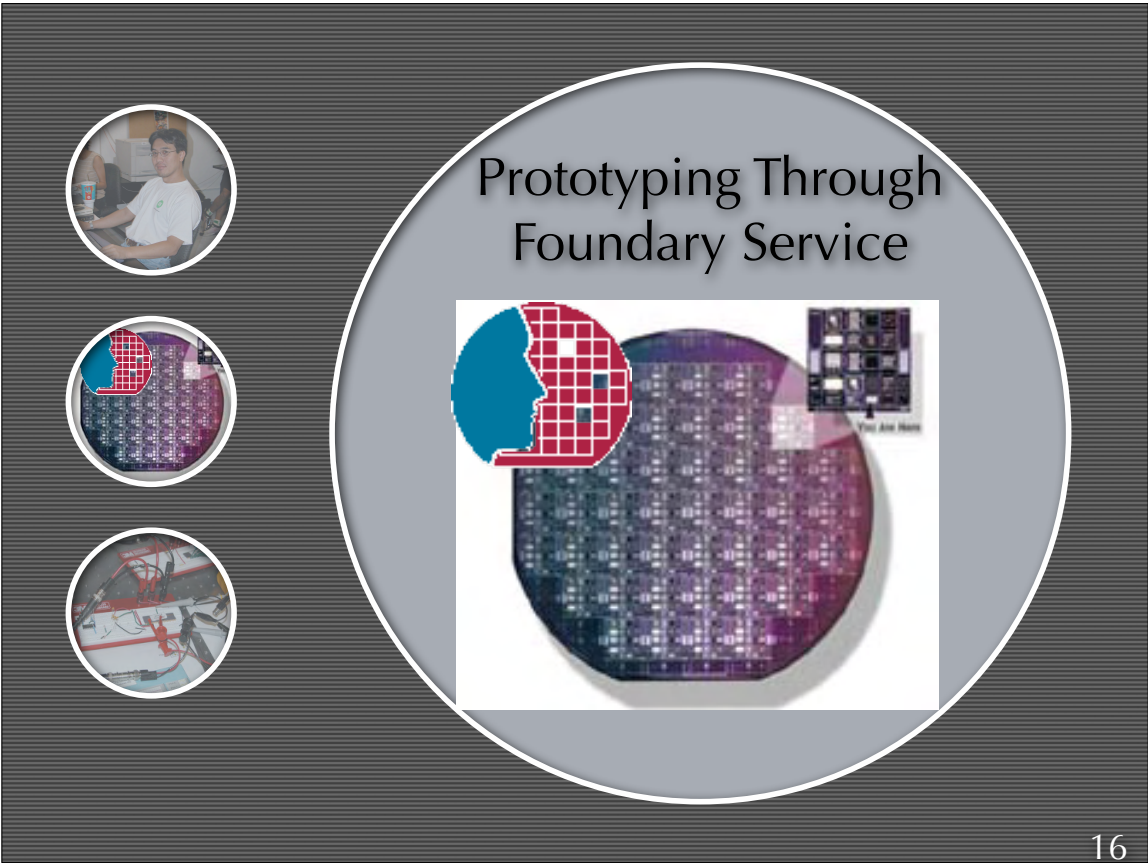


Automated Pumping

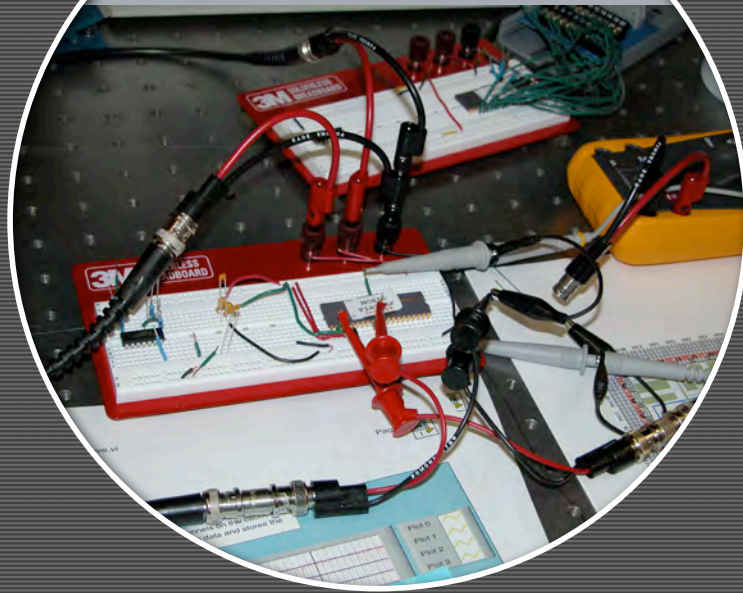
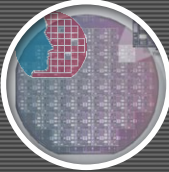
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CMOS Prototyping

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Circuit Characterization

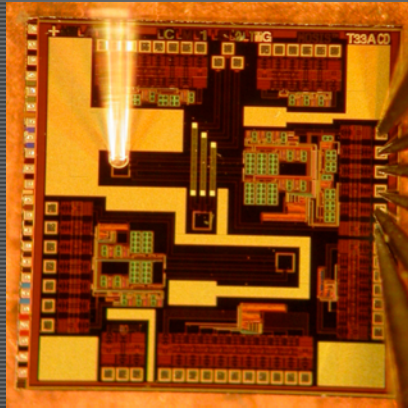


Microfabrication Methods

- Photolithography
- Reactive Ion Etching
- Metalization
- Ion Sputtering
- Dielectric Deposition
- BioMEMs



CMOS Biochip

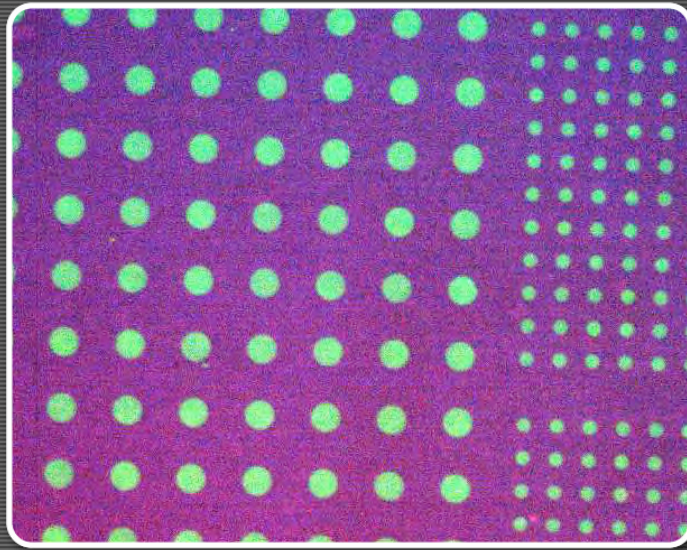


- 1 Photodetectors
- 2 Cyclic Voltammetry
- 3 Capacitance
- 4 Electrical Sensors
- 5 Data Transfer

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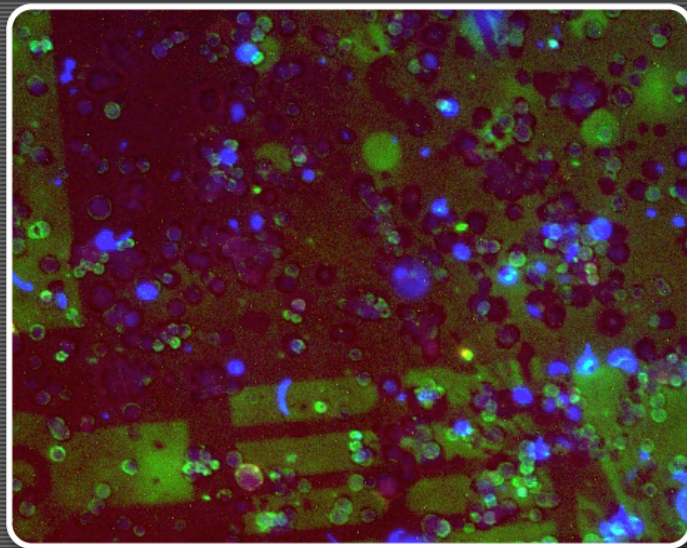
Cell Attachment

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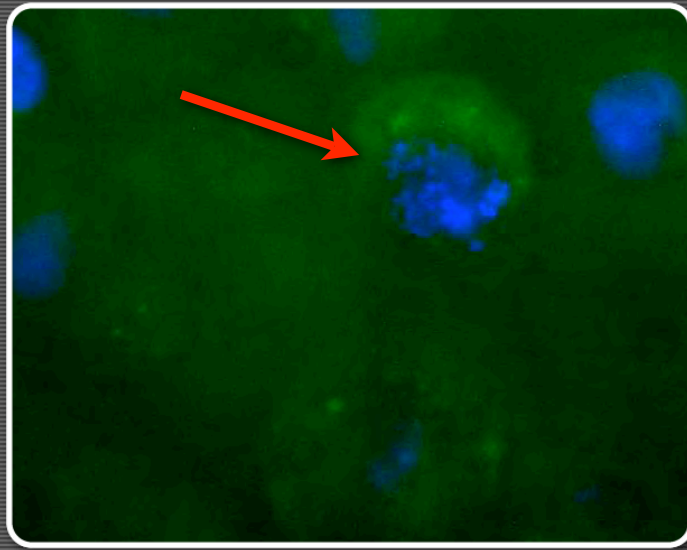
Poly-L-lysine Patterning

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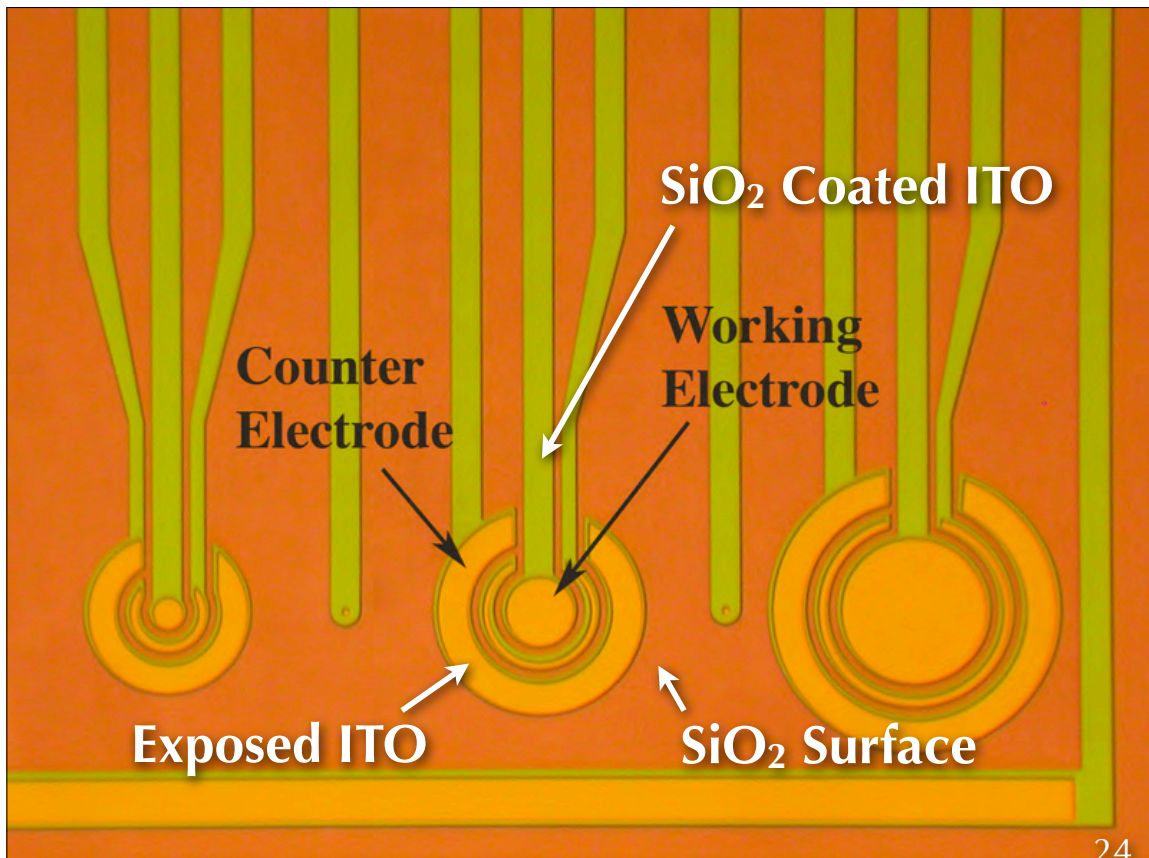


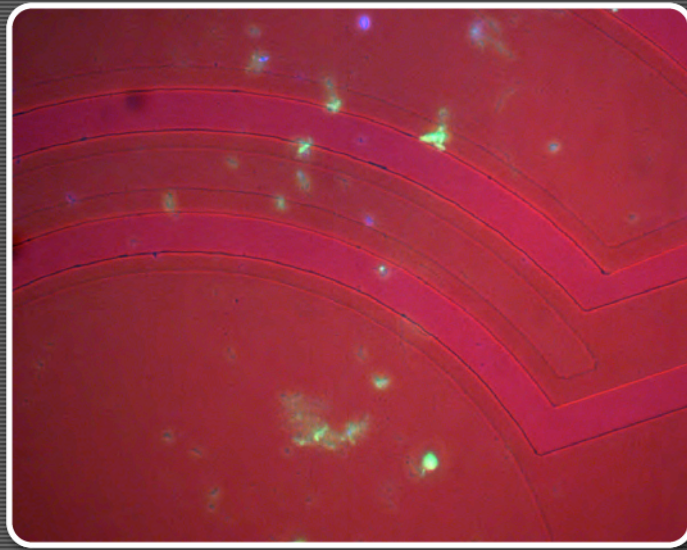
DU145 Cells on
Poly-L-lysine Patterned SiO₂

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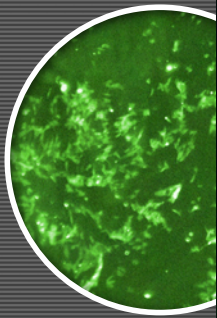
Cell Splitting



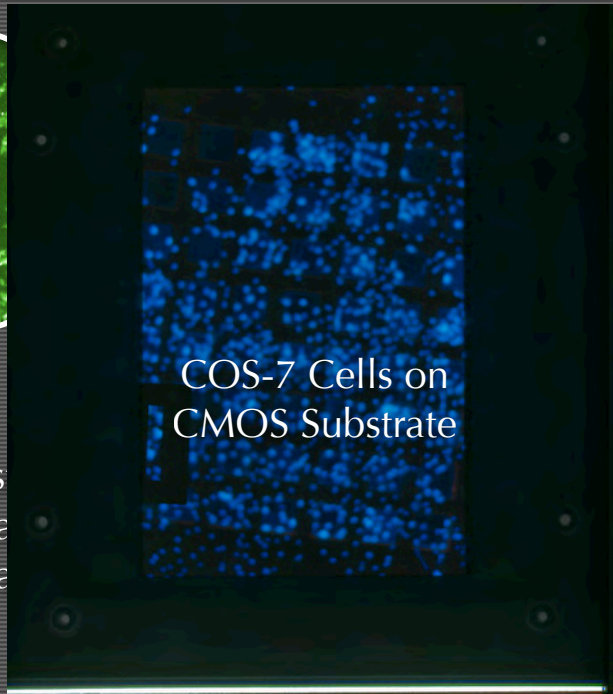


HL-1 Cardiomyocytes on
Fibronectin Coated Electrodes

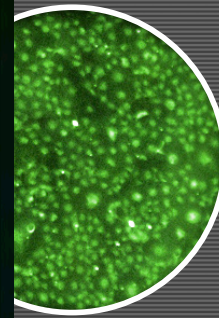
Cell Attachment



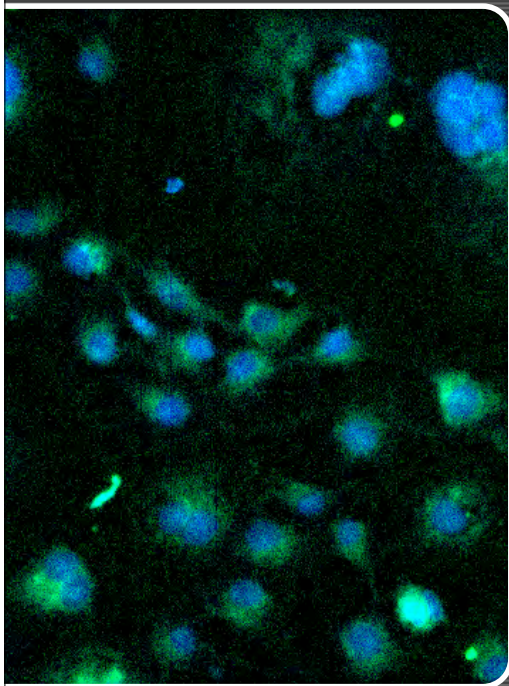
Fibroblasts on
ITO Coated
Substrate



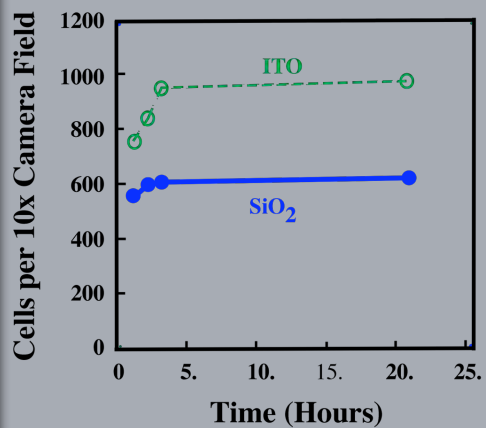
COS-7 Cells on
CMOS Substrate



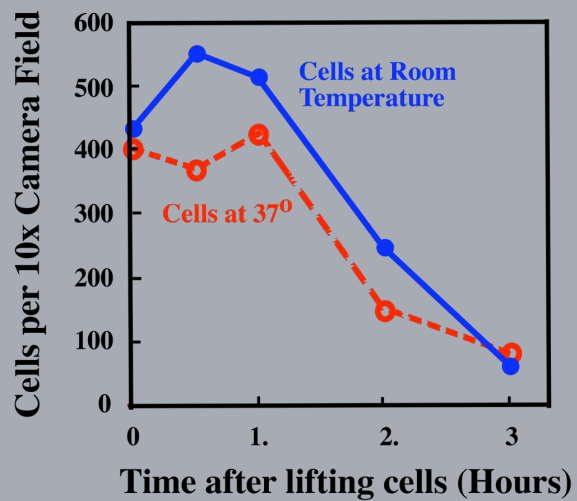
COS-7 Cells on
Coated
Substrate



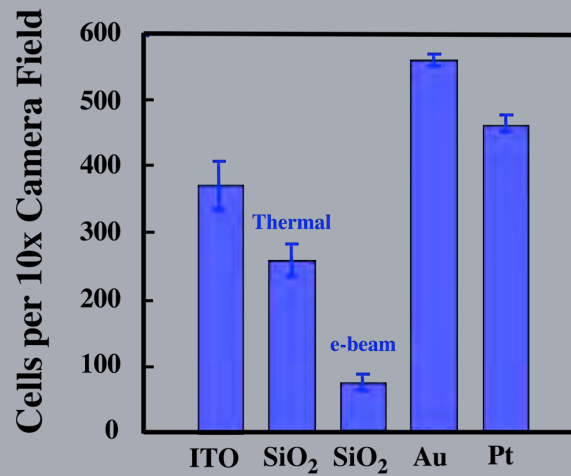
COS-7 Cell Attachment



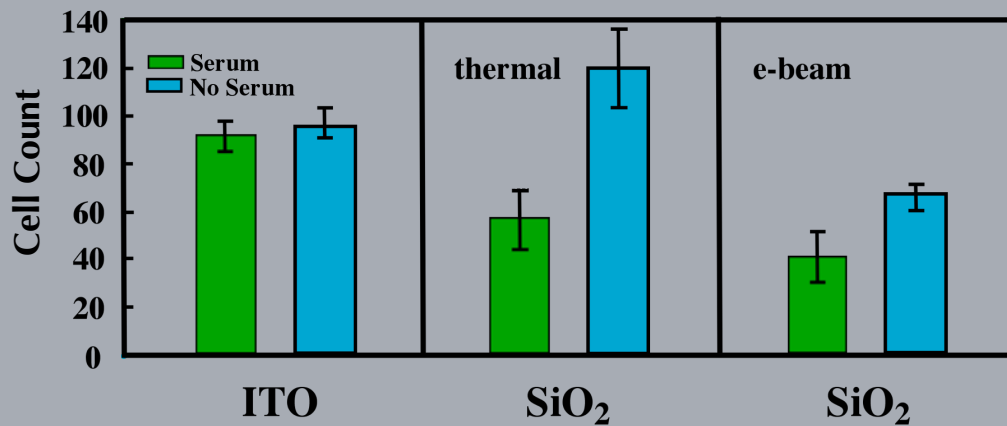
Temperature Dependent Attachment



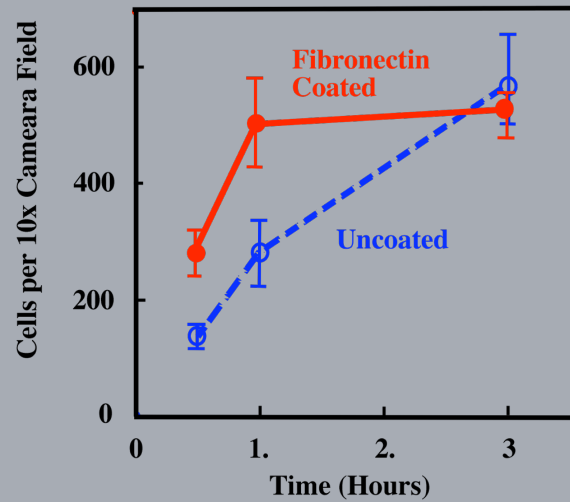
Surface Attachment



Serum Effects

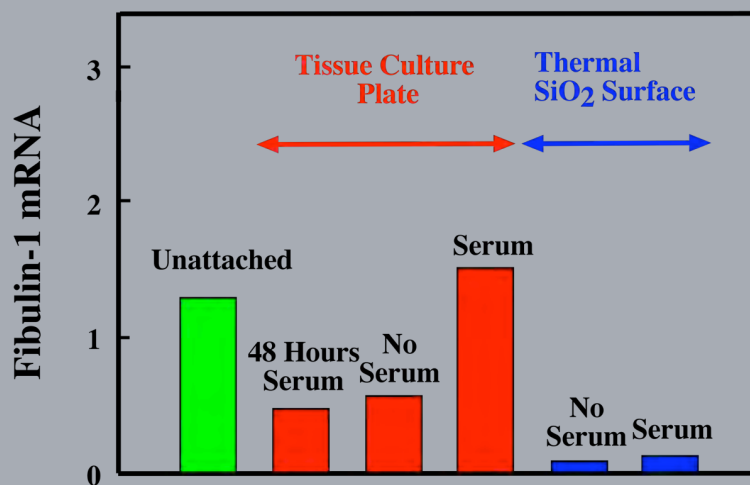


Surface Conditioning



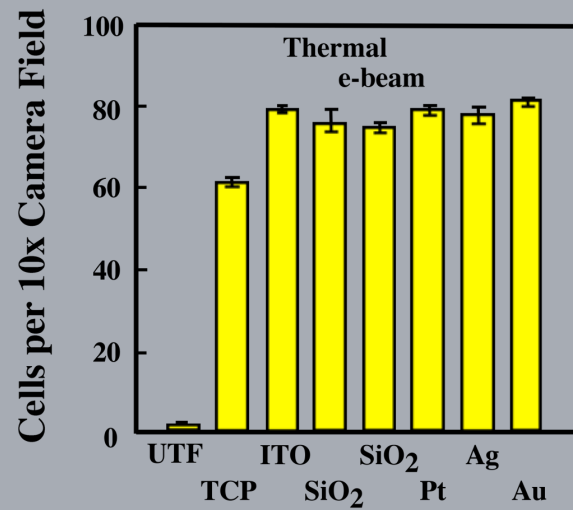
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Fibulin-1 Expression



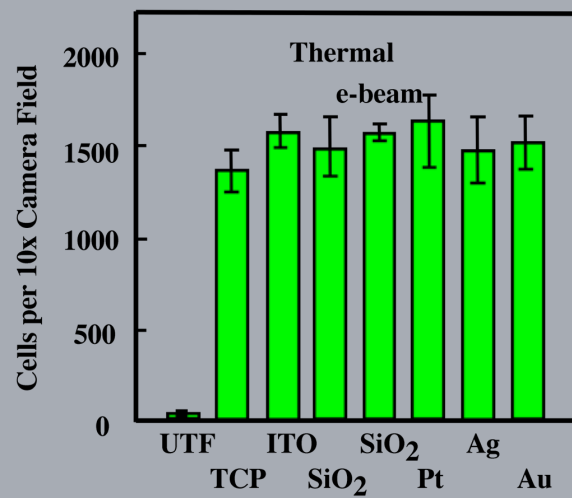
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Percent Transfection



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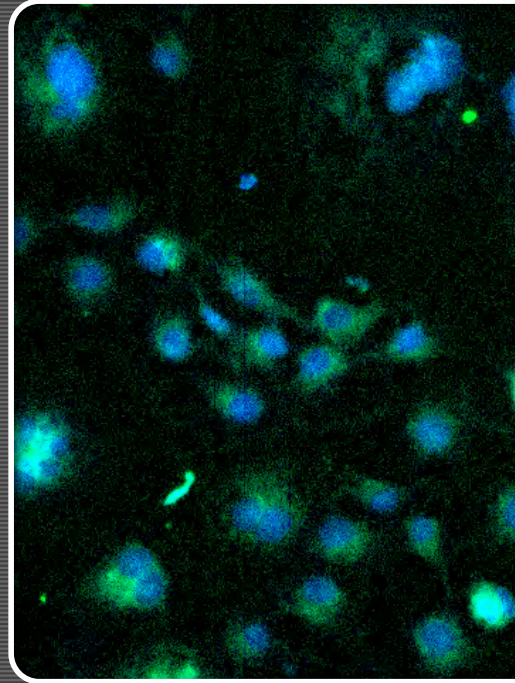
EGFP Gene Expression on COS-7 Cells



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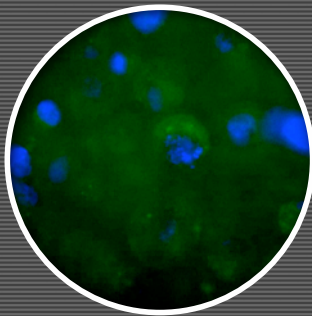
Cell Attachment

- Possible on semiconductor surfaces
- Mammalian cells used
- Do not need precoated surfaces

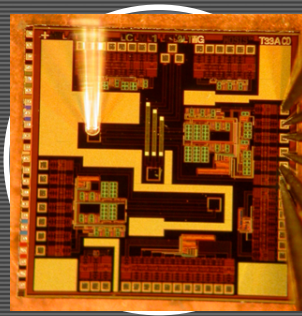


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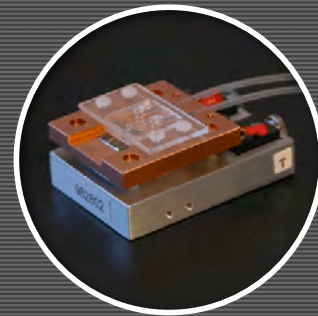
Summary



Cell-Based
Biosensor



CMOS
Sensor



Biochamber

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