BioLab-On-A-Chip

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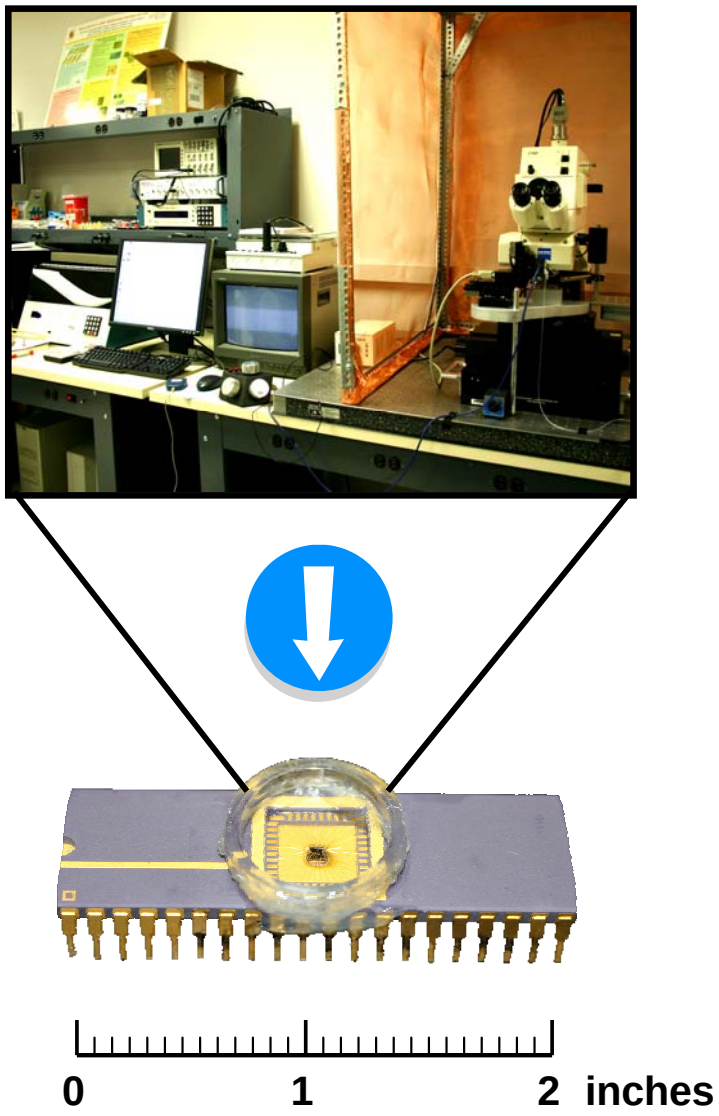

Goals

- Replace Cell-Biology Lab Infrastructure
- Explore Applications
  - ❖ Electrophysiology
  - ❖ Monitoring of Cells
  - ❖ MEMS (Micro-Electro-Mechanical Systems)

Highlights

- Cell Culture and Data Acquisition
- Packaging
- Sensor Design

Cell Culture and Data Acquisition

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1. Cell Culture

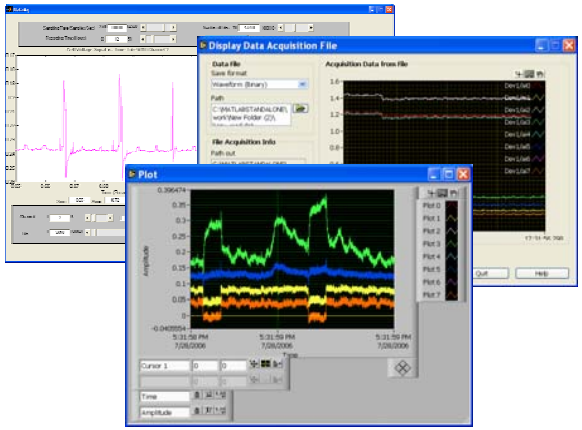
- Incubate at 37°C, 5% CO_2
- Subculture at 60-80% confluence

2. Setup

- Place cells and media into chip well
- Mount chip onto test board within Faraday cage
- Place shielded setup inside incubator

3. Data Acquisition

- Acquire with legacy software using MathWorks Data Acquisition Toolbox
- Test with NI-DAQmx Tools for live monitoring



Packaging

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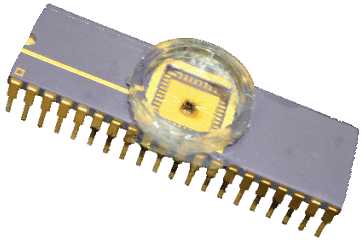


Previous Design

- 40-pin DIP Package
- Electroless Plating (Au)
  - ❖ Corrosion free
  - ❖ Low noise
  - ❖ More surface area

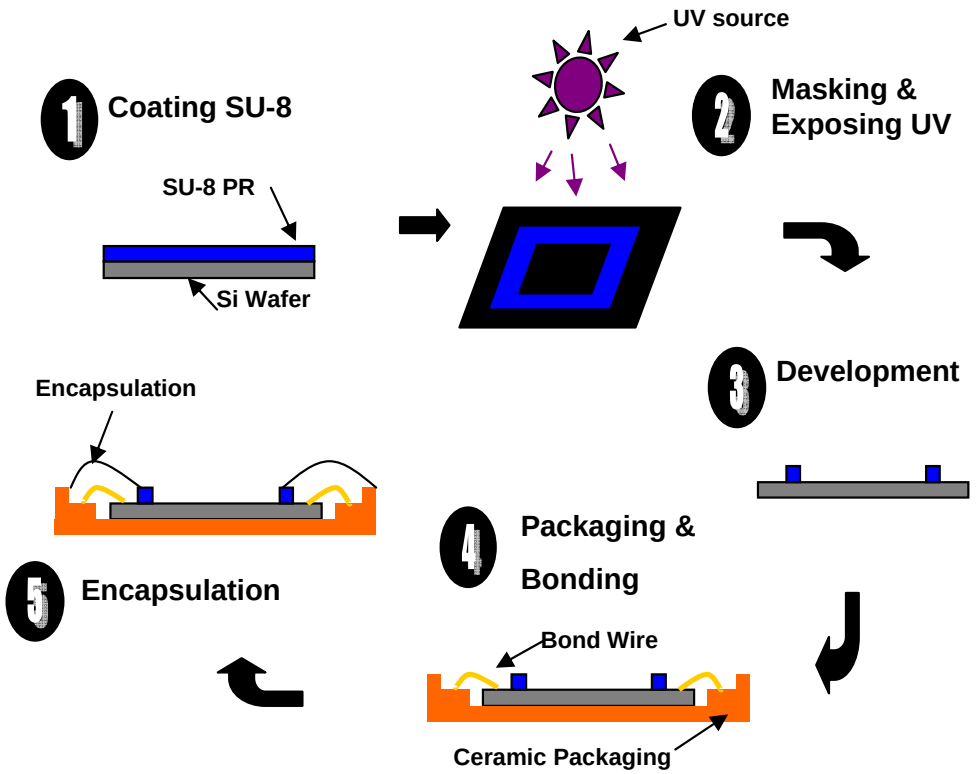
Problems

- Aqueous absorption
- Loctite™ 3340 fails to promote cell growth

Selected Solution

- Place SU-8 perimeter
- Backflow encapsulating material

SU-8 Packaging Process



Sensor Design

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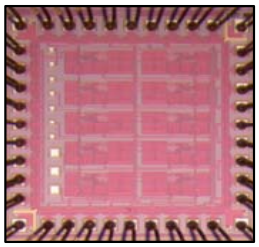
10
Electrodes

128 x 128
Electrodes



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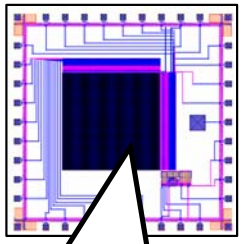

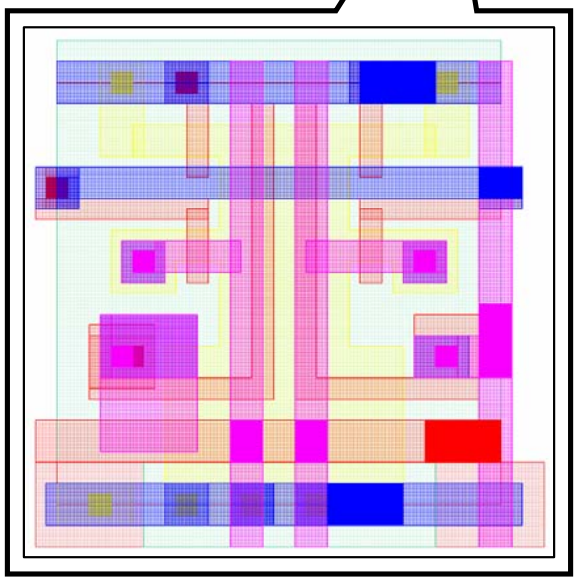

Tape-Out of Nine Chips

- Use of 2 and 3 Metal Processes for Window Cut Patterning
- Various In-Pixel Pre-Amplification Configurations

Highlights

- High Spatial Resolution
- 128 x 128 Array of Electrodes per Chip
- Neurite Outgrowth Monitoring