

BioMEMS Device Integration, Packaging and Control for BioMEMS

Rubloff Research Group Accomplishments

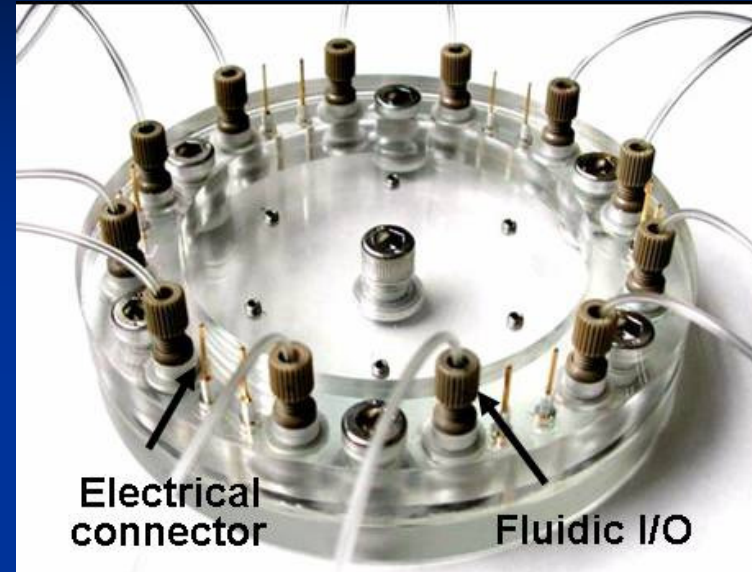
BioMEMS Device Integration, Packaging and Control for BioMEMS

Accomplishment

- Microfabricated SU8 on a Pyrex wafer defines the microchannel structure
- Patterned gold electrodes define the readily addressable assembly sites
- SU8-PDMS junction by pressure provides leak-tight and nonpermanent sealing
- Fluidic/electric ports provide transport and electric signal for biochemical assembly
- LabView-based control system coordinates liquid transport and electrodeposition

Significance

- Integrated microfluidic system provides electric signal and optical access for biochemical assembly
- Nonpermanent sealing provides *ex situ*, post-process analysis
- Reusable packaging components
- Microfluidic Control System provides systematic operation process



People involved

Jung Jin Park, Xiaolong Luo, Theresa Valentine, Gary Rubloff

Collaborations with Reza Ghodssi, Hyunmin Yi, Greg Payne, Bill Bentley

Links

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Publications

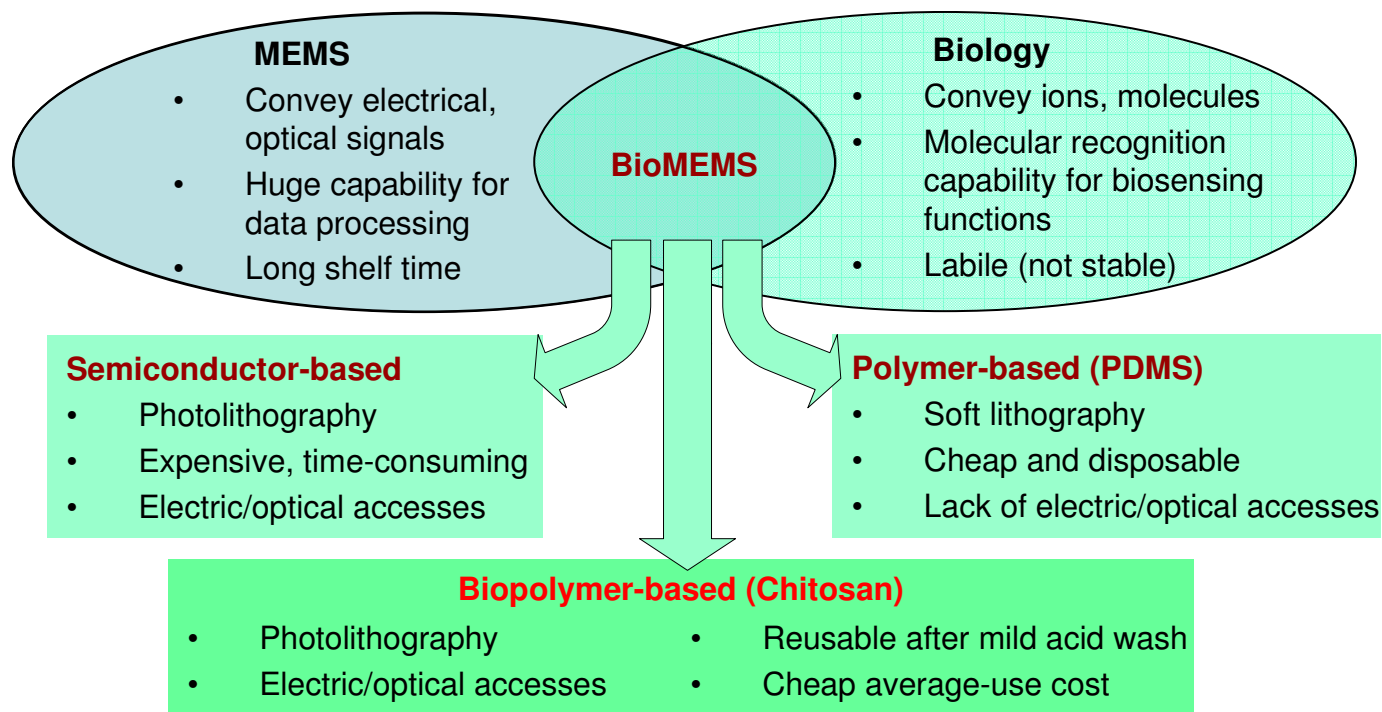
- X. L. Luo, A. T. Lewandowski, H. M. Yi, R. Ghodssi, G. F. Payne, W. E. Bentley and G. W. Rubloff, "Reproducible Assembly and Catalytic Activity of a Metabolic Pathway Enzyme in Reusable BioMEMS Devices", *Lab on a Chip*, Submitted.
- J. J. Park, X. L. Luo, H. M. Yi, T. M. Valentine, G. F. Payne, W. E. Bentley, R. Ghodssi and G. W. Rubloff, "[Chitosan-mediated in situ biomolecule assembly in completely packaged microfluidic devices](#)", *Lab on a Chip*, 2006, 6, 1315-1321.
- J. J. Park, T. M. Valentine, R. Ghodssi, and G. W. Rubloff, "[Integrated Chip and Package Design for Surface-Controlled Bioreaction Processes with Robust, Reusable Fluidic Sealing](#)", *Proceedings of MicroTAS 2005, 9th International Conference on Miniaturized Systems in Chemistry and Life Sciences* (2005)

Presentations

- J.J. Park, M.A. Powers, X. Luo, R. Ghodssi, and G.W. Rubloff, "[BioMEMS Chip and Package Design for Surface-Controlled Bioreaction Processes](#)", *American Vacuum Society 52nd International Symposium & Exhibition*, Boston, MA, October 30-November 4, 2005.
- J. J. Park, T. M. Valentine, R. Ghodssi, and G. W. Rubloff, "[Integrated Chip and Package Design for Surface-Controlled Bioreaction Processes with Robust, Reusable Fluidic Sealing](#)", *Proceedings of MicroTAS 2005, 9th International Conference on Miniaturized Systems in Chemistry and Life Sciences* (2005)

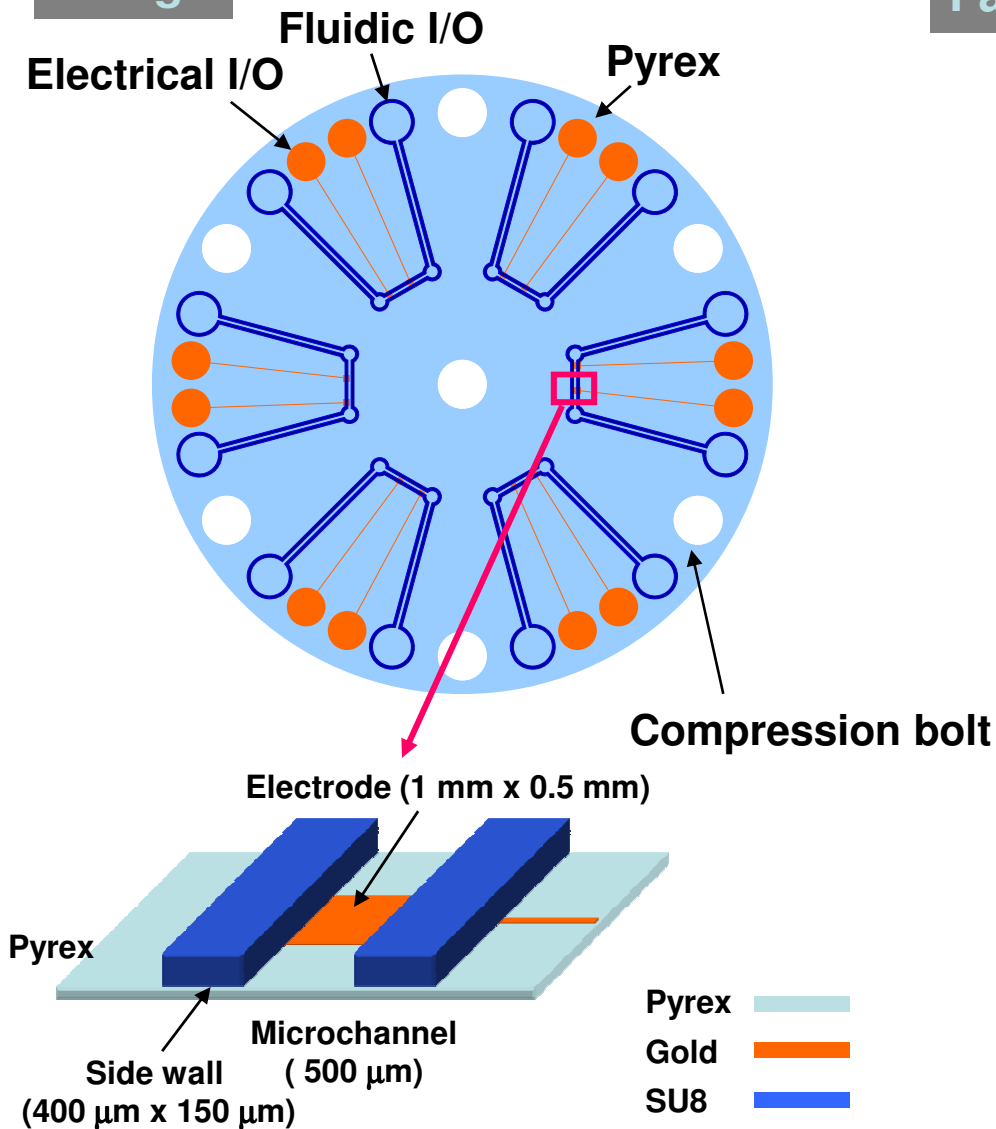
Biopolymer-based BioMEMS

- BioMEMS refers to the application of microelectromechanical systems (MEMS) to biology. Current bioMEMS devices are either semiconductor-based or polymer-based, mostly PDMS.
- A biopolymer-based bioMEMS devices are created when chitosan is enlisted. The unique properties of aminopolysaccharide chitosan confer the bioMEMS device with special advantages such as reusability and low average-use cost.

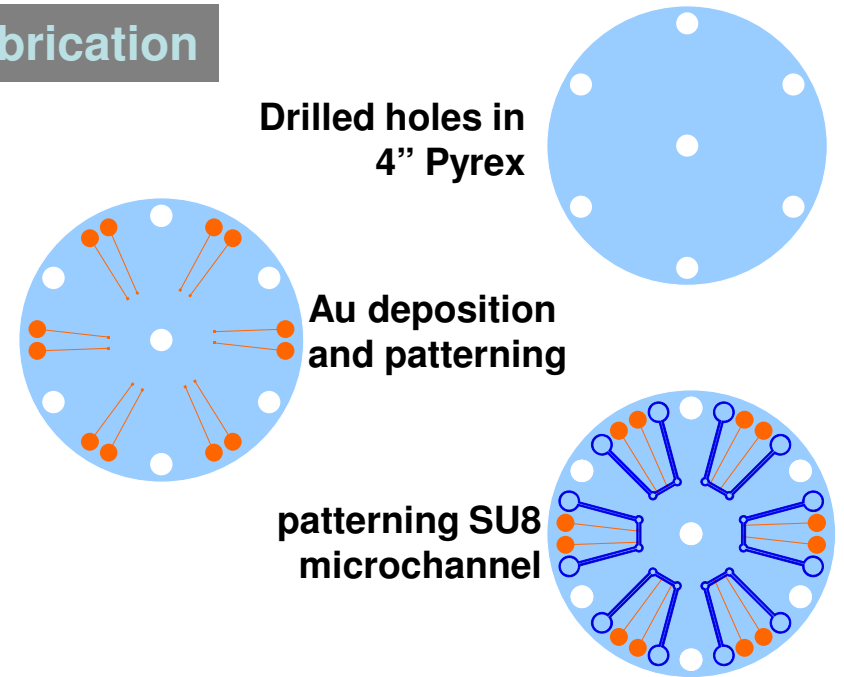


BioMEMS Device Design and Fabrication

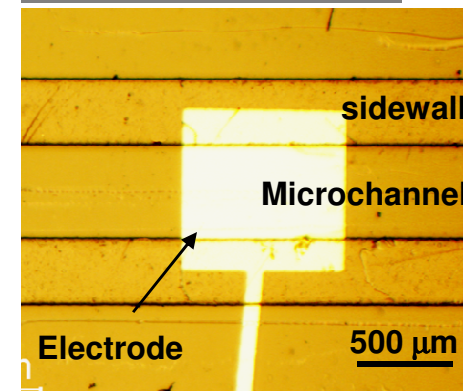
Design



Fabrication

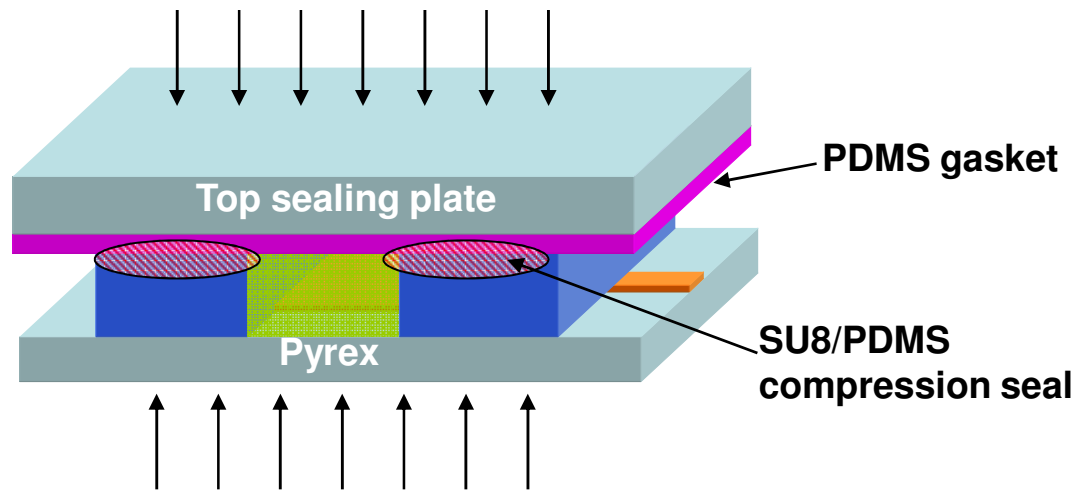


Optical micrograph

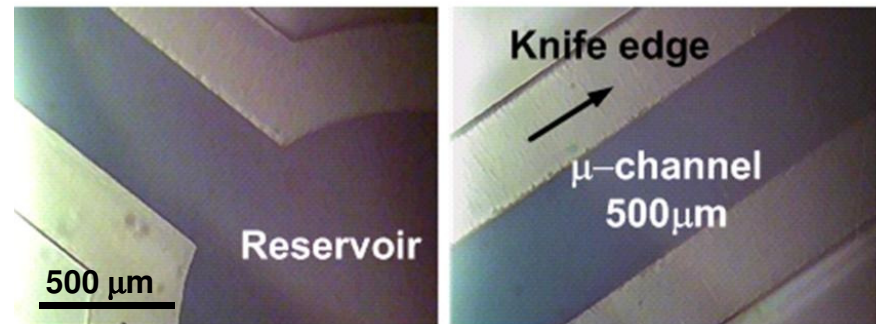
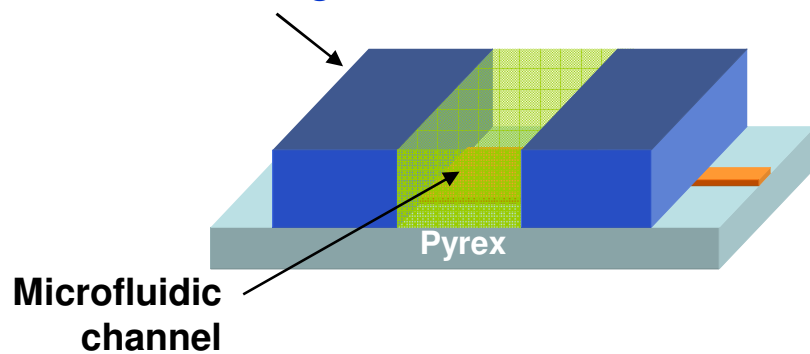


Compression Sealing

SU8 knife edge / PDMS gasket sealing

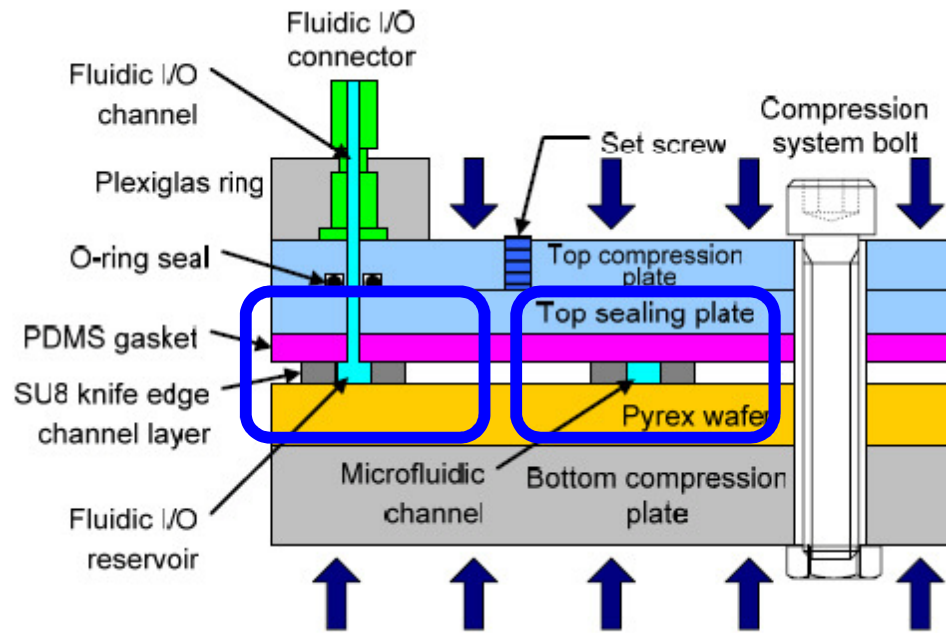


SU8 Micro-knife-edge



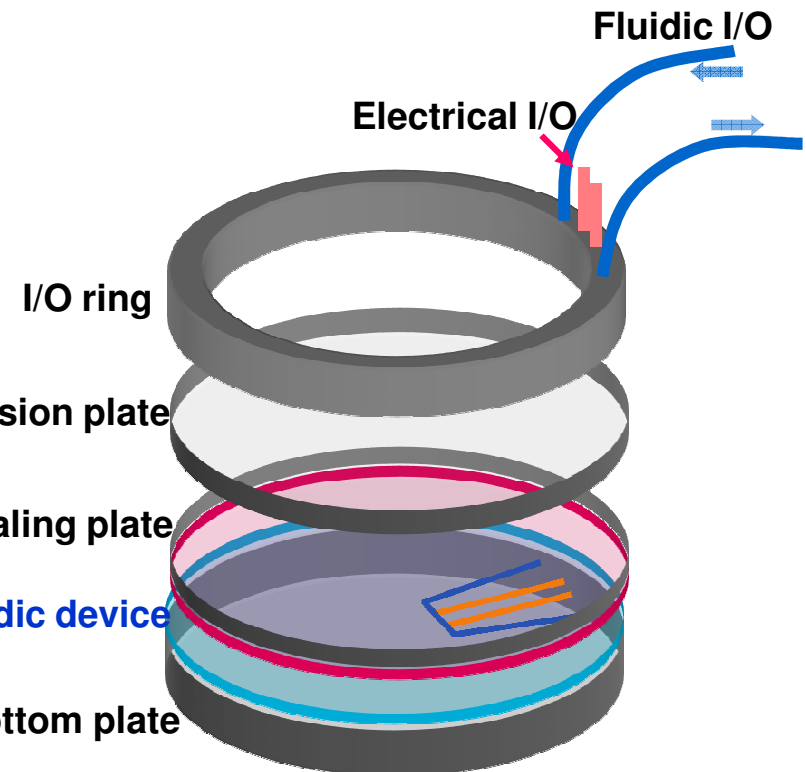
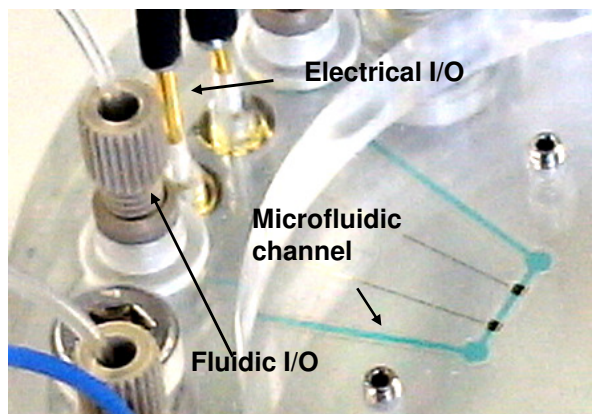
Testing flow rate: ~ 50 μl/min

Microfluidic Package



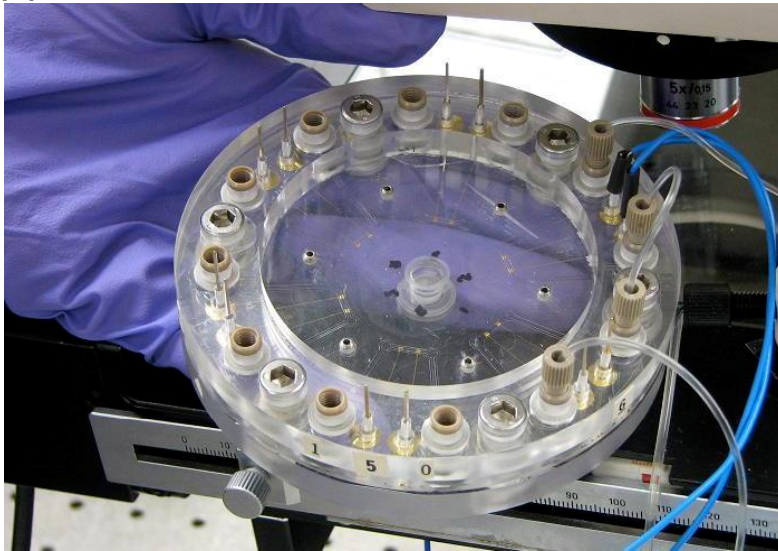
Features

- **Non-permanent sealing**
- **Fluidic and electrical I/O**
- **Reusable packaging components**
- **Transparency for optical access**

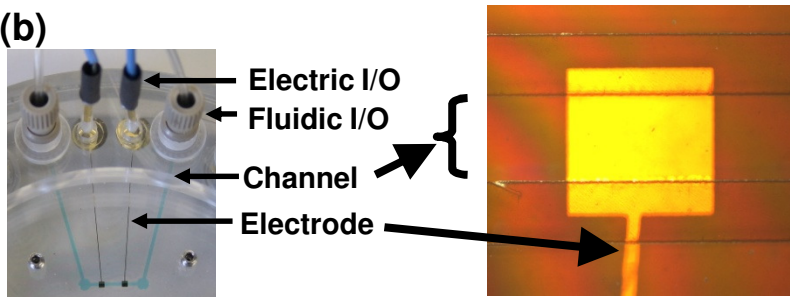


BioMEMS Device and Control System

(a)



(b)



(c)

