

Ever-Smaller Circuit Boards Enable Most Compact, Capable Medical Devices

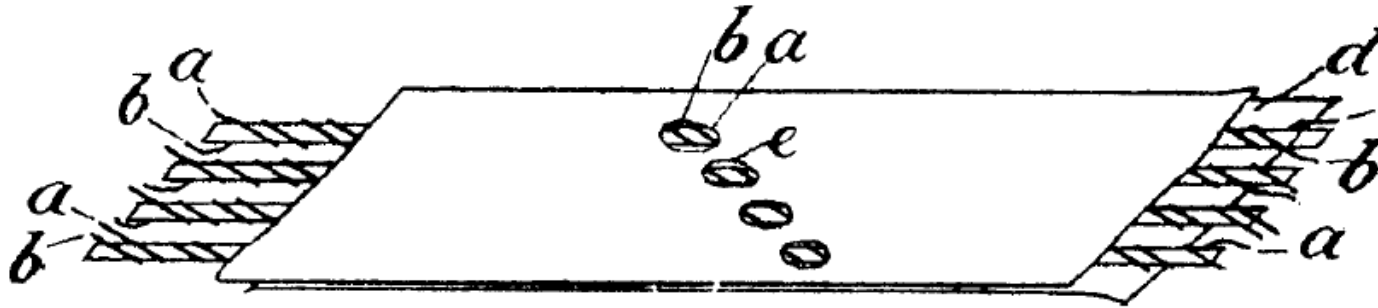
Presented by Randal Chinnock
MDM East 2011 Innovation Briefs



About Optimum Technologies

- We are not a flex manufacturer
- We are a product development company specializing in biomedical optics
- We use flex technology to develop smaller, more capable optics-based medical devices
- I will mention some flex manufacturers in my talk, but I am not offering any endorsements

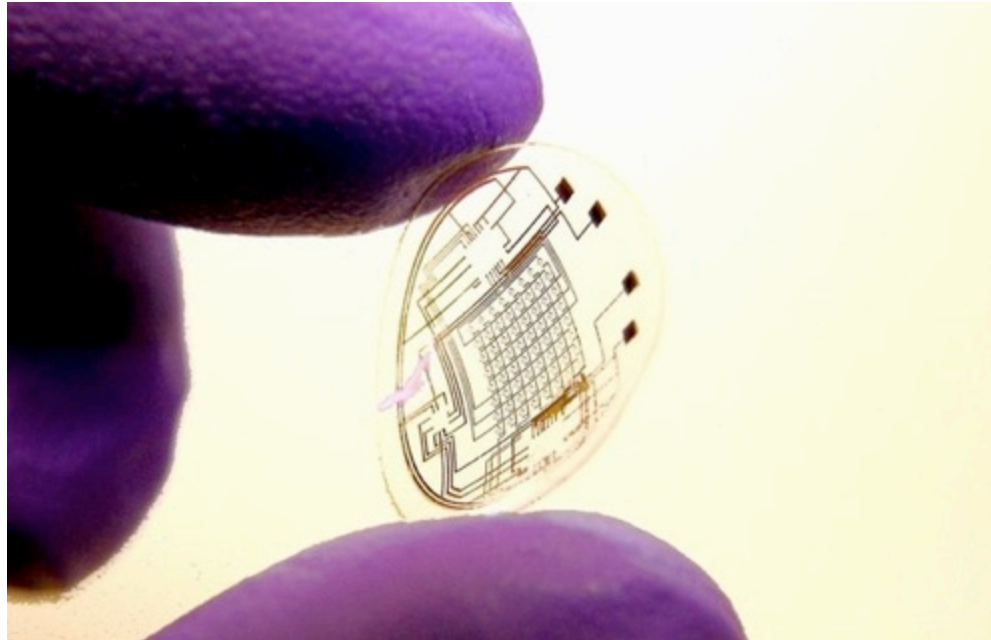
1903⁽¹⁾



- Albert Hanson filed his "printed" wire patent in England
- Aimed at solving the telephone exchange need

(1) The Circuit Centennial, Ken Gilleo, Ph.D. , ET-Trends, gilleo@ieee.org

2011⁽²⁾



Flexible circuit on a contact lens

(2) Babak Parviz, University of Washington

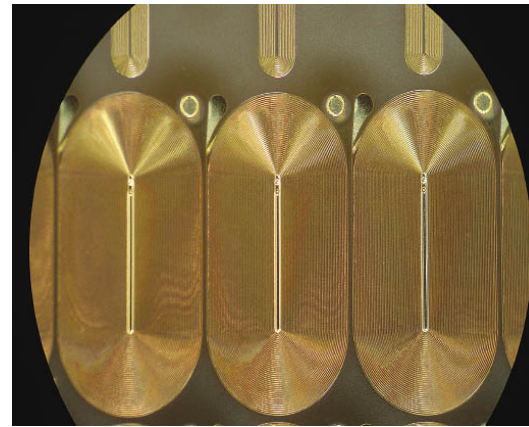
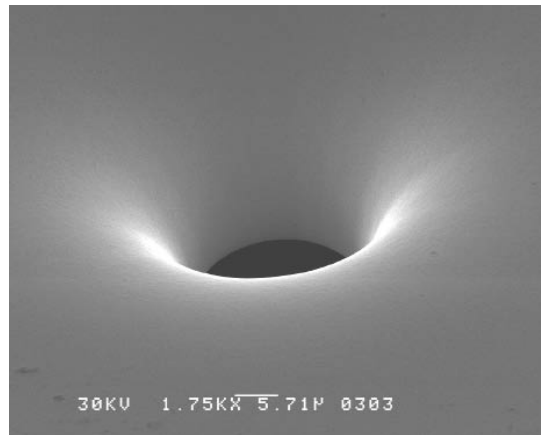
Why Use Flex Circuits?

- Lighter/more rugged than rigid PCBs
- Can be bent & folded (Oragami)
- Can articulate (e.g., through hinges)
- Mounting features easily integrated
- Unique connectivity capabilities, including replacement for wires & harnesses
- Can have flexible & rigid sections

Courtesy: Cybersensors

Capabilities

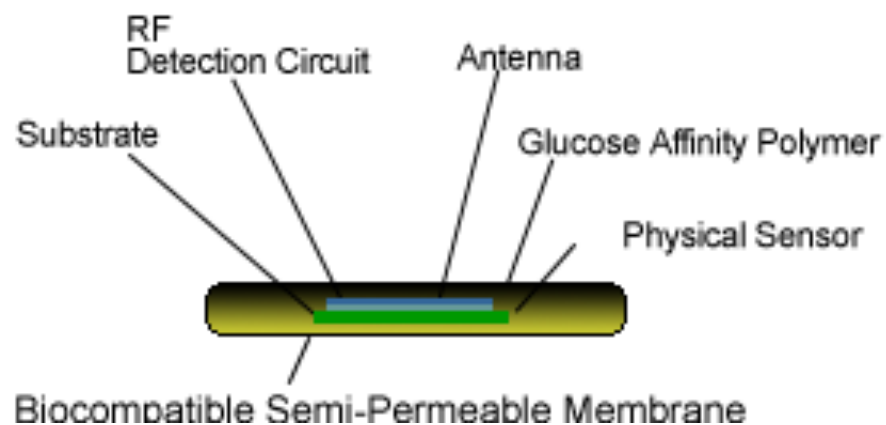
	Commercial	High Resolution
Processes	Wet-Etch	Photolithography, Electrochemical Deposition
Minimum Trace/Space	.004"	.0001"
Minimum Drill Hole Size	.005"	.0019"



ERMF images, courtesy Metrigraphics

Current Applications

Implantable Glucose Sensor

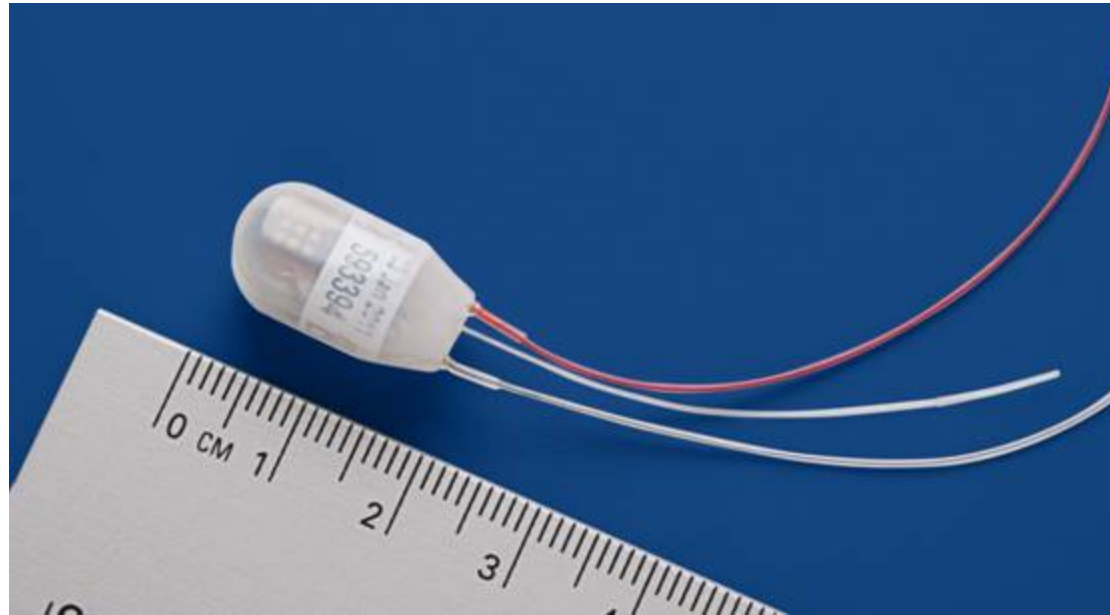


Courtesy: Cybersensors

Airway Device

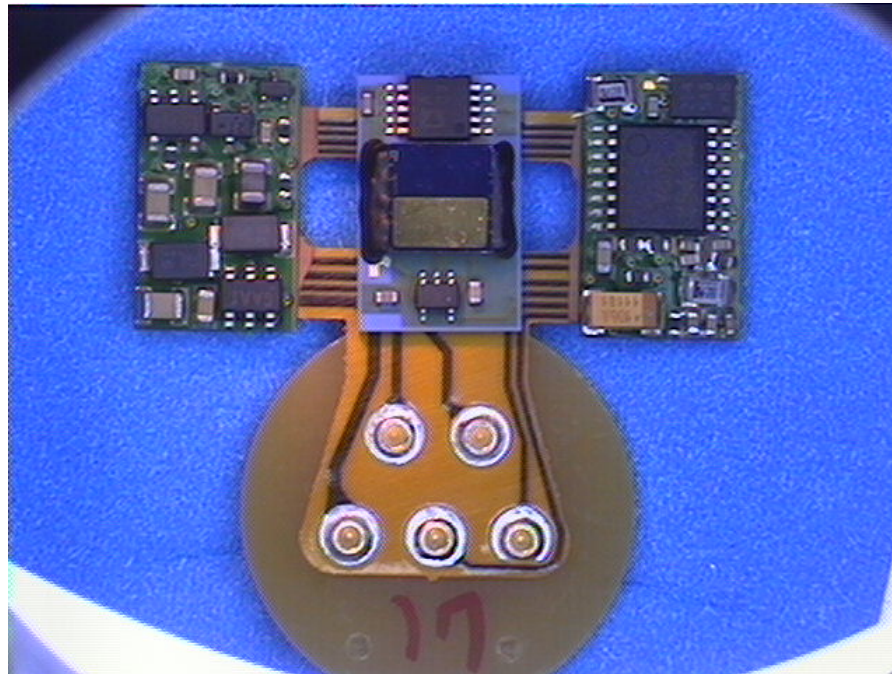


Implantable Sensor



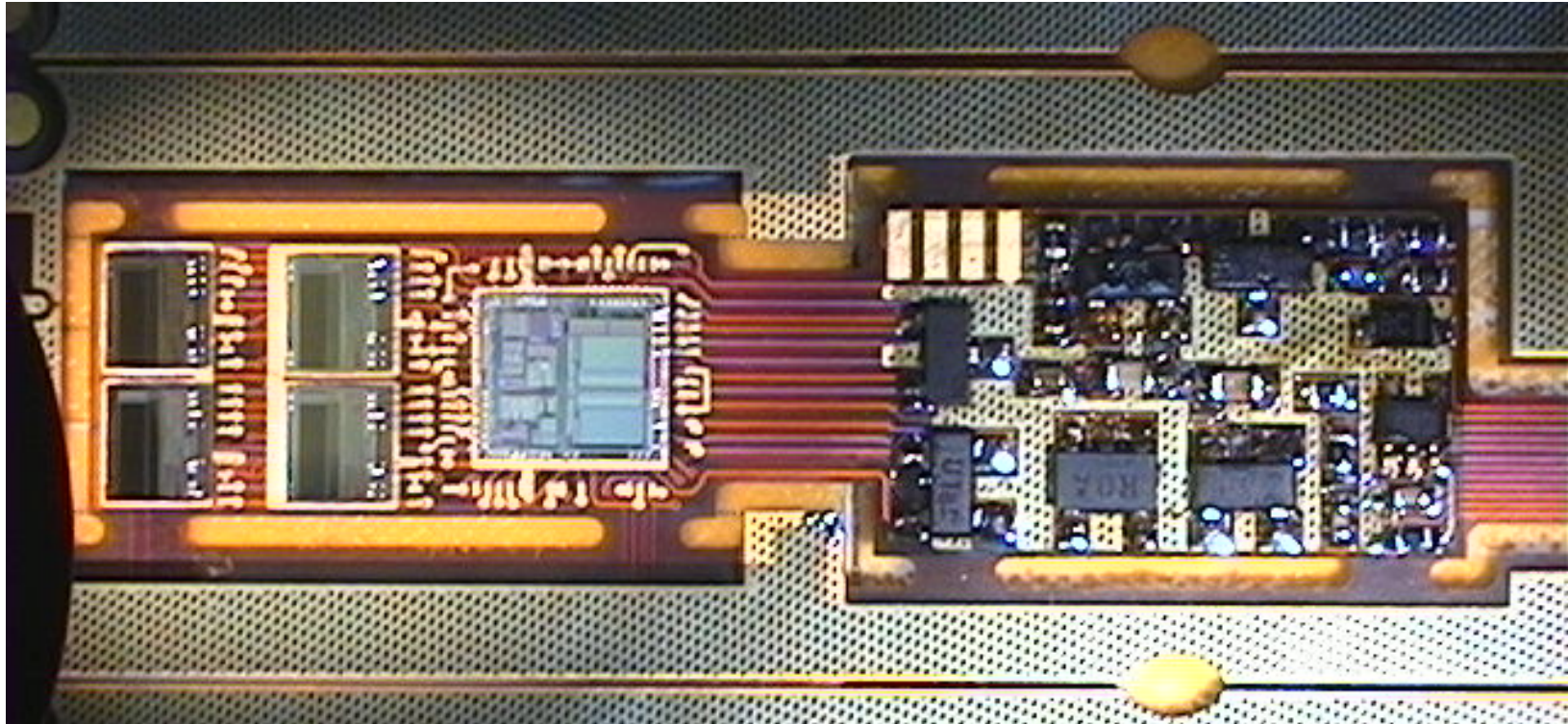
Courtesy Data Sciences International

Gas Sensor



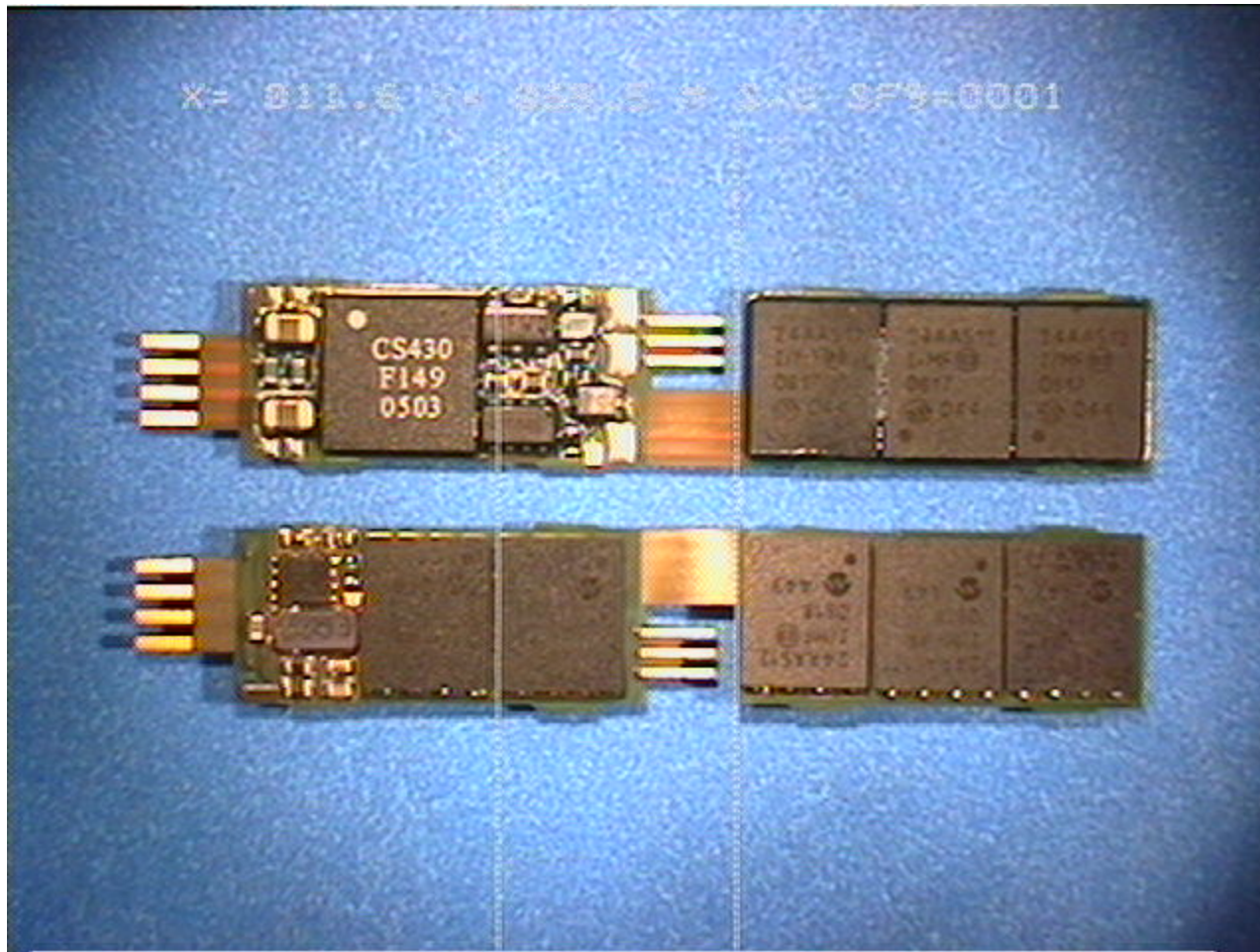
Courtesy TASK Microelectronics

Archival Fish Tag



Courtesy TASK Microelectronics

Wildlife Tracker



Courtesy TASK Microelectronics

Endoscopic Camera



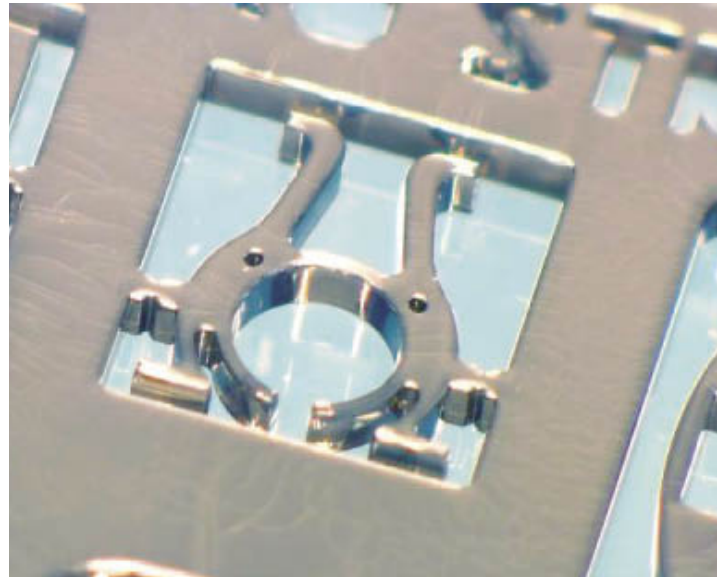
Courtesy TASK Microelectronics

Other Applications

- Ultrasound angioplasty devices
- Blood chemistry sampling devices
- Retinal implants
- Remote transmitters for data transfer in and out of the human body
- Magnetic sensing and analysis devices
- Lab-on-a-pill, smart pill
- pH monitoring
- Fall sensors

Challenges

- Biocompatibility
- Material quality as features shrink
- Overlap with MEMS & nano technologies



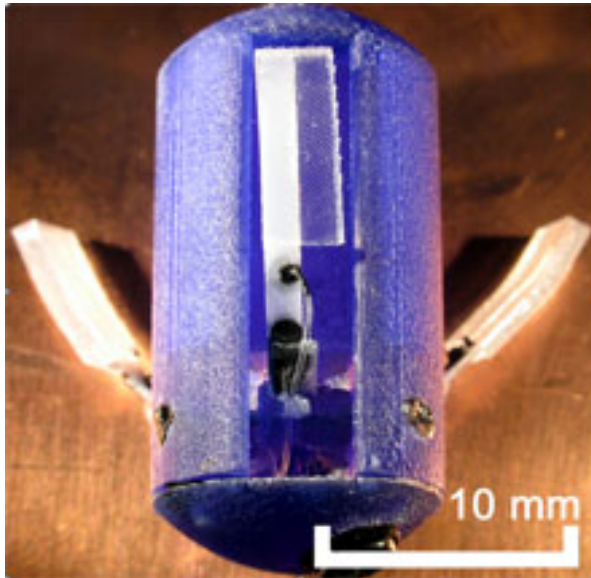
Microlens Holder
Courtesy Metrigraphics

What's Coming Next?

Forecast

- Ever-denser circuits and systems
- New functionalities enabled by smaller and more specialized ICs
- Manufacturing processes based on self-assembly
- Micron-scale metal interconnects incorporated onto thin flexible plastic substrates
- Biocompatible polymer encapsulation

Devices in Development

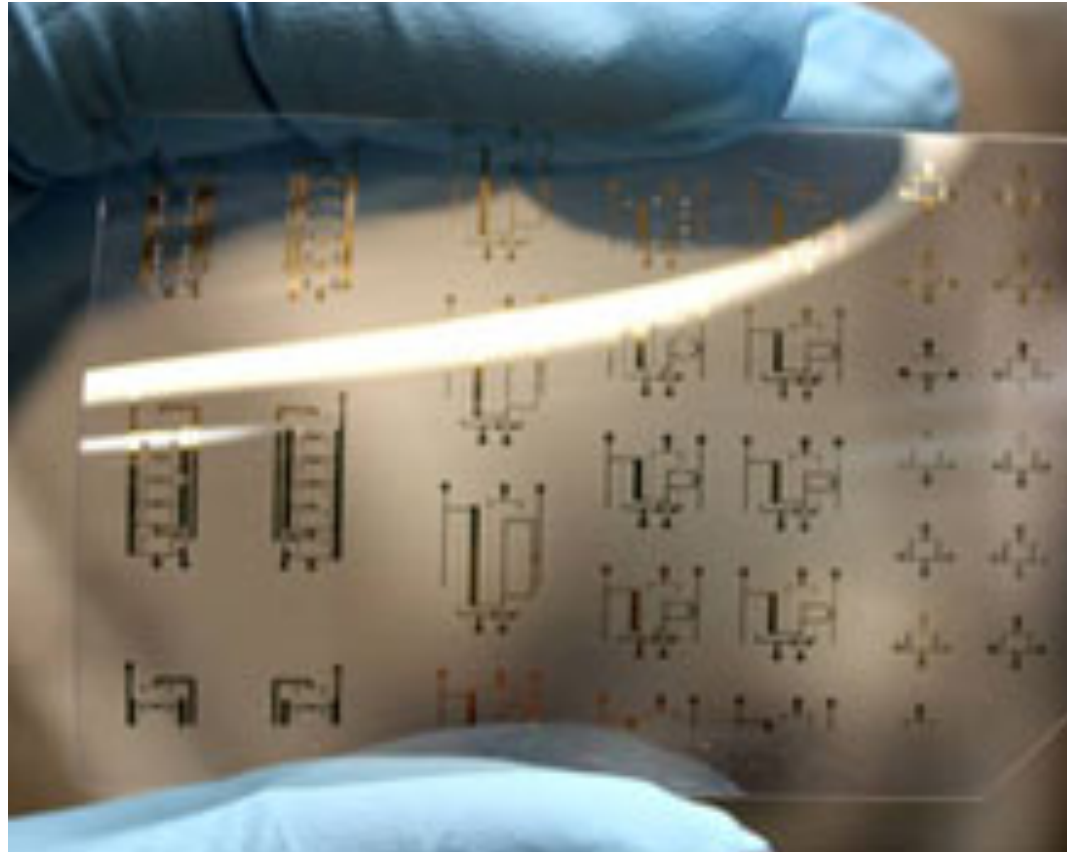


Anchorable pillcam
Courtesy: Carnegie Mellon University



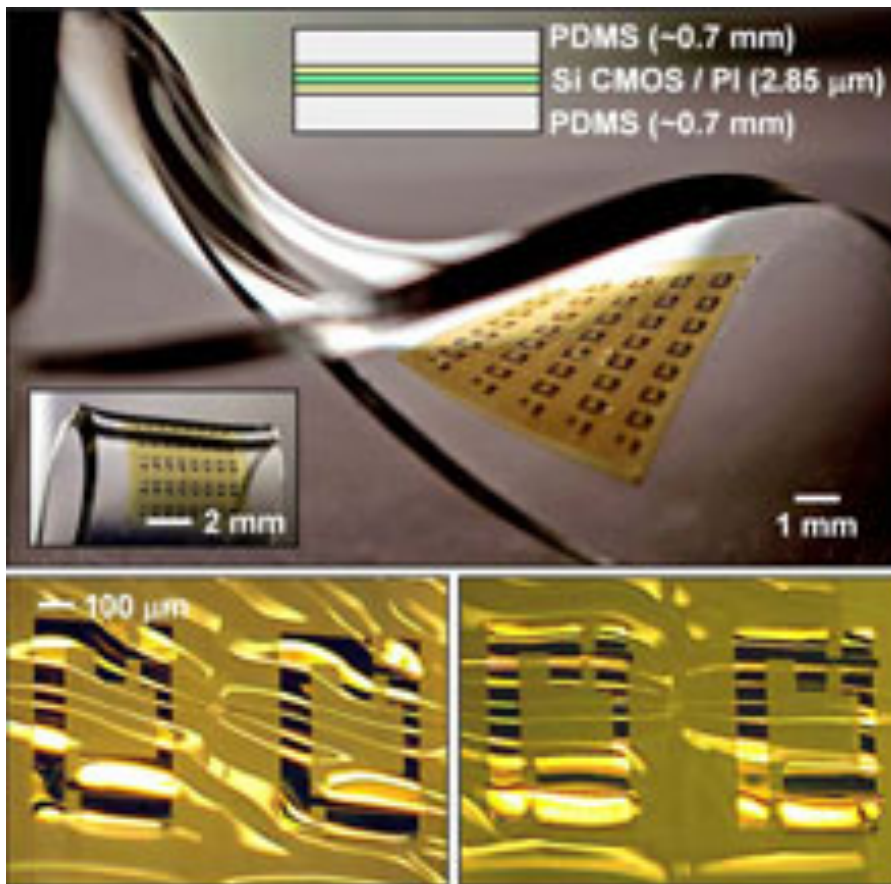
Self-assembling robot
Courtesy: MIT

Impact of Nanotechnologies



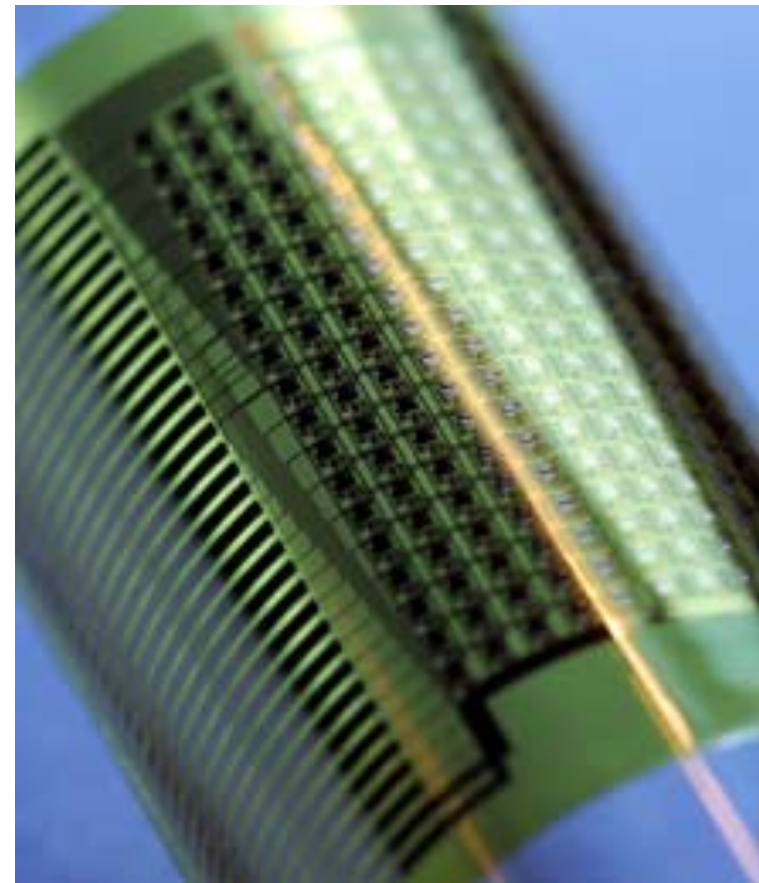
Circuits made from printed carbon nanotubes.
Courtesy Northwestern University

Impact of Flexible Single Crystal Silicon



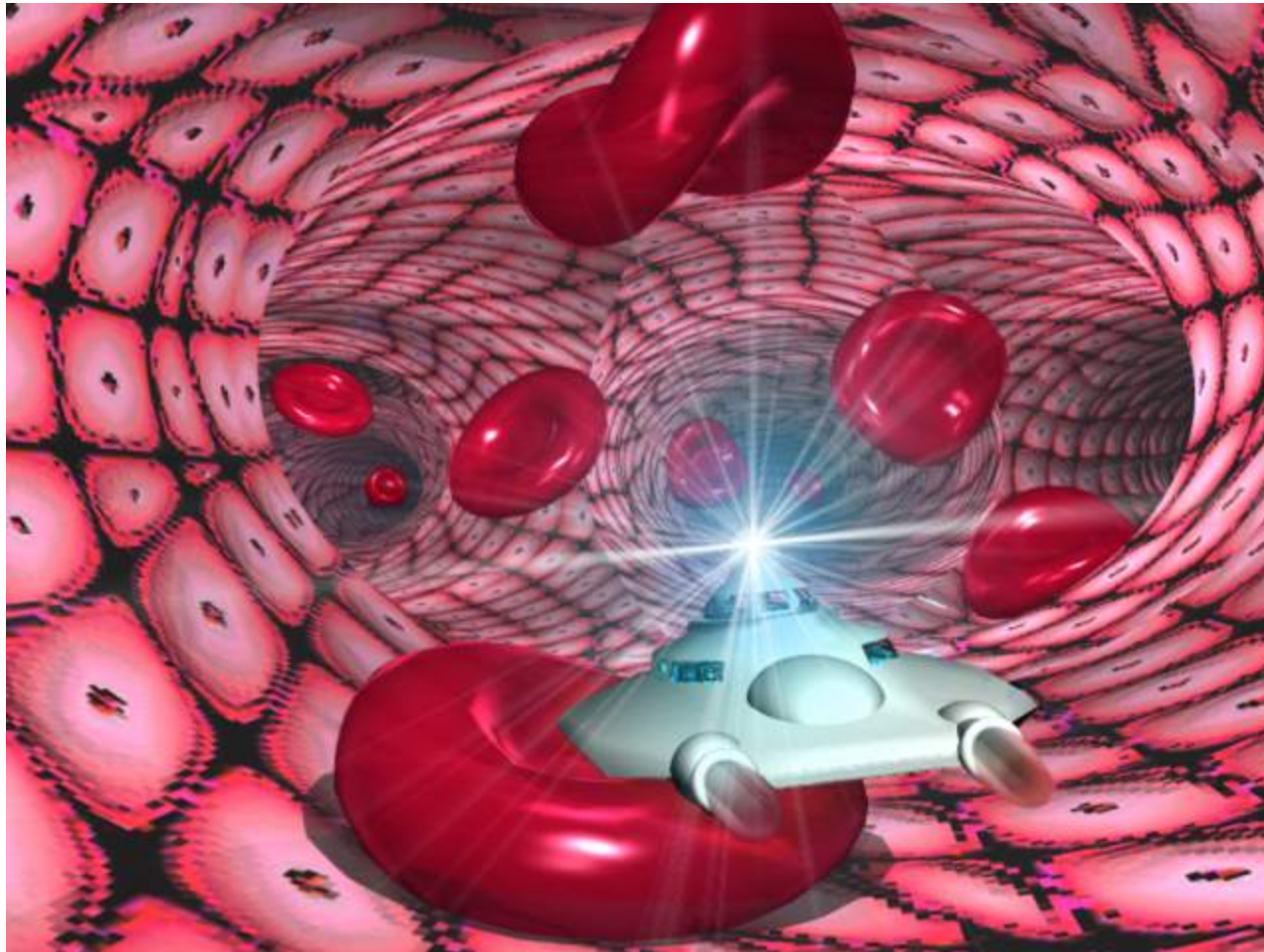
Circuits made from single crystal silicon.

Courtesy University of Illinois



Electrophysiology sensor.

“Fantastic Voyage” to Nanomedicine



Randal Chinnock, CEO
Optimum Technologies, Inc.
508 765-8100

rchinnock@optimum-tech.com

www.optimum-tech.com