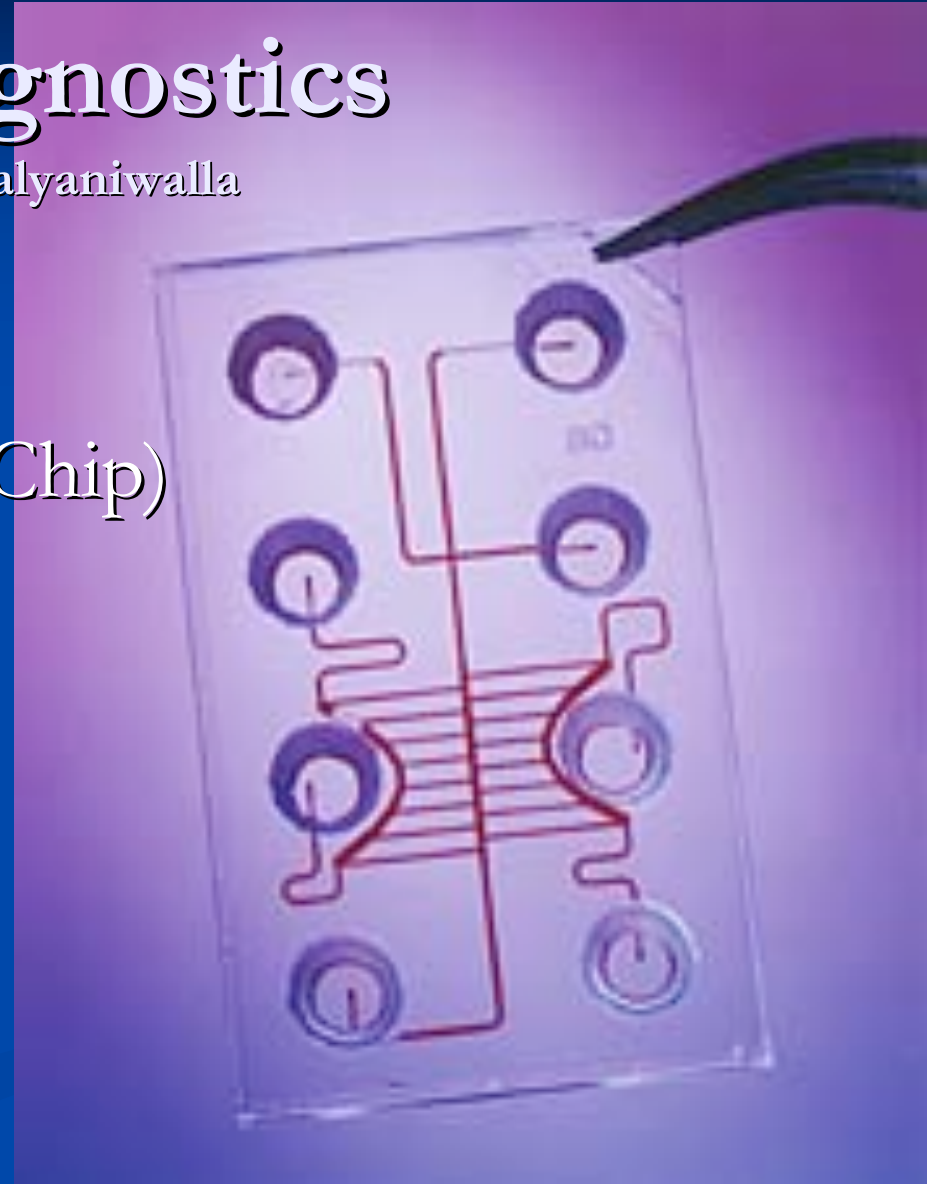


# Nanodiagnositics

By: Kaizan Kalyaniwalla

- Nanochips
- Microfluidics (Lab-on-a Chip)
- MEMS
- Other diagnostic devices
- Applications/Current Research

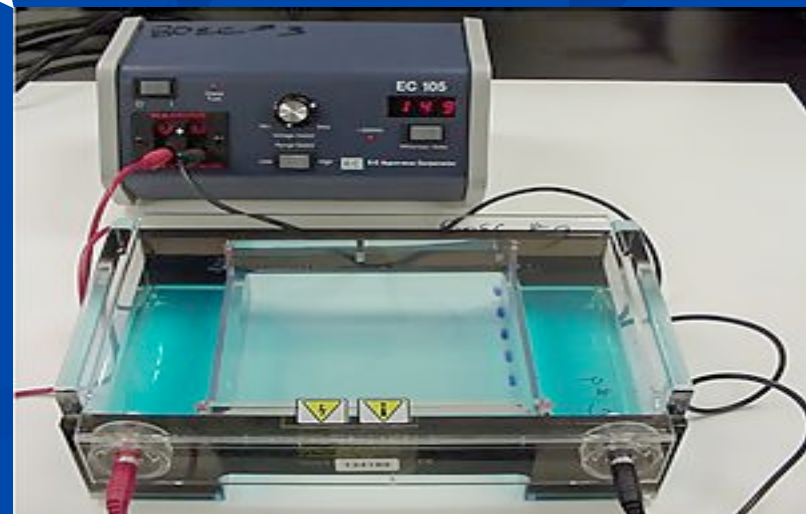
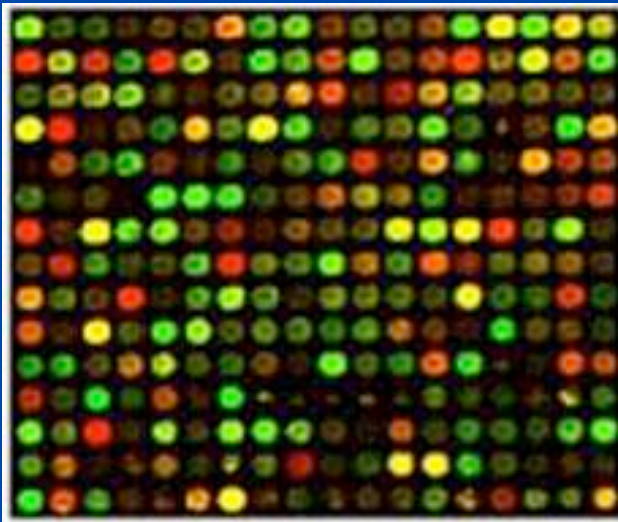


# What is Nanodiagnosics?

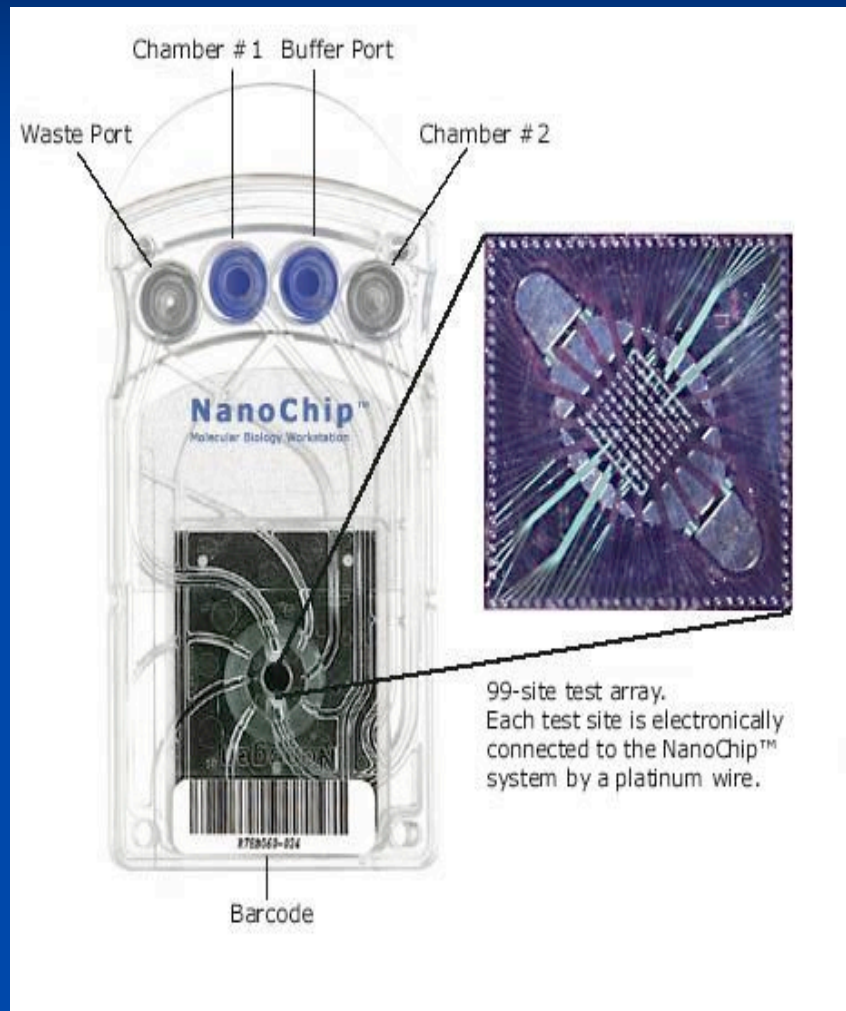
- The extension/integration of molecular diagnostics to the nanoscale
  - Tests become quicker, more sensitive, and more flexible with the use of nano-size devices
  - Analyze DNA sequences, diagnose disease, and analyze cell composition
- Better than conventional diagnostic approaches

# Current Diagnostic Techniques for DNA Analysis

- PCR
- Sanger Method
- Gel Electrophoresis
- DNA microarrays



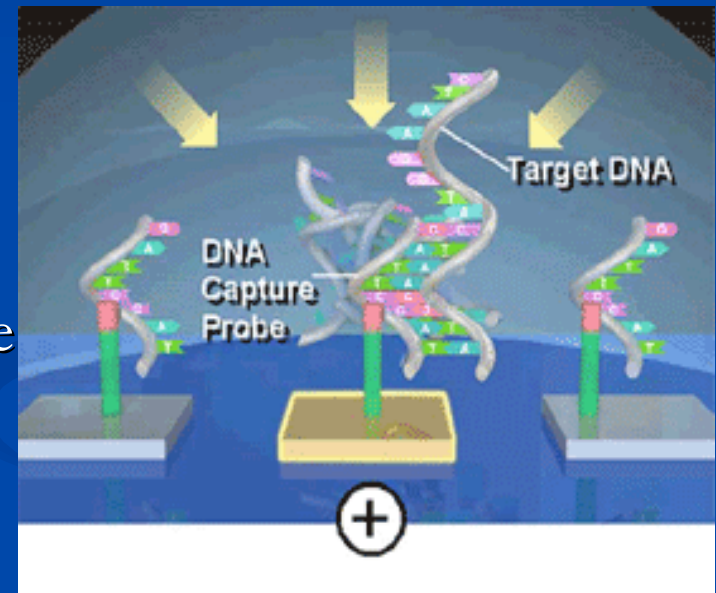
# Nanochips



- Company named Nanogen invented an electrically powered array
- Electric Current separates DNA probes based on size and charge (difference between microarray?)
  - Increased Specificity
- Secret-Each site is controlled by a nanochip that is connected to an on board computer through platinum wiring.

# Nanochips (cont.)

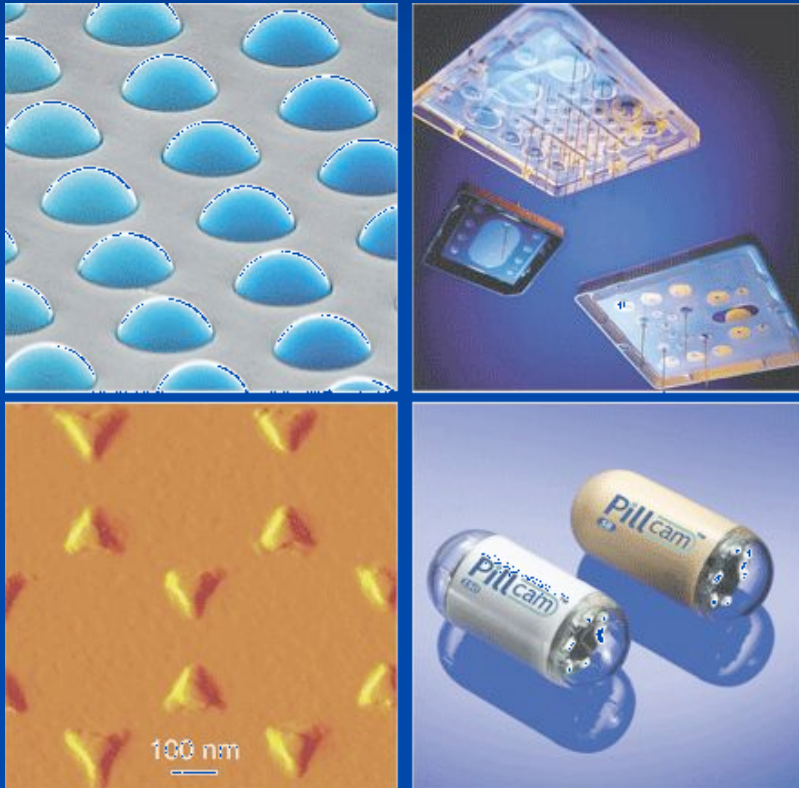
- Binding is accelerated 1000 times faster compared with passive methods.
- Helpful in diagnosing disease
  - If a mutation in a particular gene is known, it will be determined if you are pre-disposed to that disease through hybridization
  - Test Results will be given on the spot
- Current Research
  - Nanogen-On-chip amplification which makes small variations easier to detect



# Nanochips (cont.)

- Used to separate and isolate different cell types within blood
  - Bacteria (*E. Coli*)-separate within four minutes
  - Biological Warfare
  - Infectious Disease Agents
- Electrophoretic separation, electronic lysis of *E.Coli*, and digestion of the bacterium's leftover proteins on one chip in a flow chamber

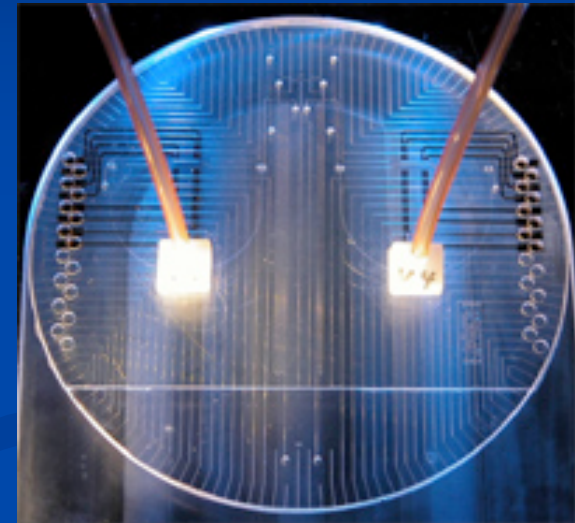
# Microfluidic Technology a.k.a. “Lab-on-a chip”



- Combination of numerous processes of DNA analysis
- Processes that deal with volumes of fluid in nanoliters
- Difference Between nanochip microarrays
  - Sequencing DNA that is completely unknown
  - Disadvantage-Devices are still very rudimentary and bulky

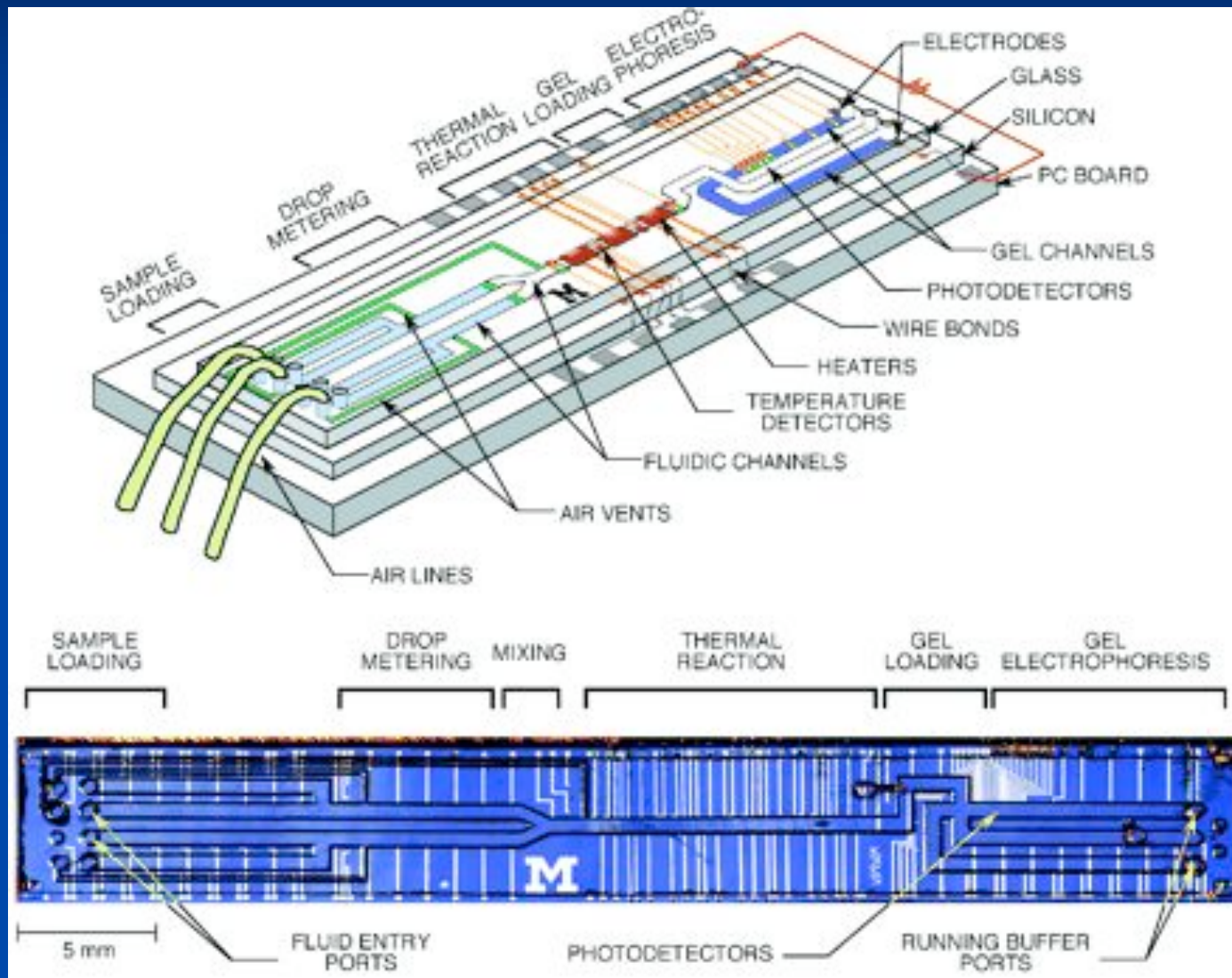
# Microfluidics (cont.)

- Entire Chip (Integrated Sequencing Microchip) the size of a microscope slide
- Devices are fabricated on a glass and silicon substrate
- Made using photolithographic techniques
- Similarities to conventional analyses procedures





# Microfluidics (cont.)



# Microfluidics (cont.)

- Small volumes mean small number of particles diffusing.
  - Disease Applications
    - Time needed to diagnose HPV infection: Reduced to 2.5 hrs. instead of weeks
- Systems have been crafted for cell composition analysis also

# MEMS

- Related to microfluidic systems only do not require reagents
- Primarily used in drug delivery systems
- Diagnostic Application-Swallowed Pill Technology by the company Given Imaging
- Helpful in diagnosing the cause of ailments



# “Gluco-Watch”



- Permeates your skin with a layer of fluidic nanochip biosensors
  - Iontopheresis
- Provides accurate readouts of glucose levels in blood
- Helps Diabetes Patients

# Applications/Current Research

- Growing trend to bring these medical diagnostic devices to the patient
  - One touch-operating systems that are easy to use
- Possible harmful physiological effects?
  - MEMS
- Ethical questions
  - Are the vast amounts of data that can be collected from a single patient morally correct?

# Applications/Current Research

- No longer ordering specific tests for specific diagnosis.
  - Large-scale tests are still far away
- Current Research on Arrays
  - Pattern Recognition
    - Example: Can be trained to recognize the odor in breath associated with lung cancer
  - Challenges are present

Questions?