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# Cloth as a Flexible Platform for Low-Cost Microfluidic Colorimetric Assay

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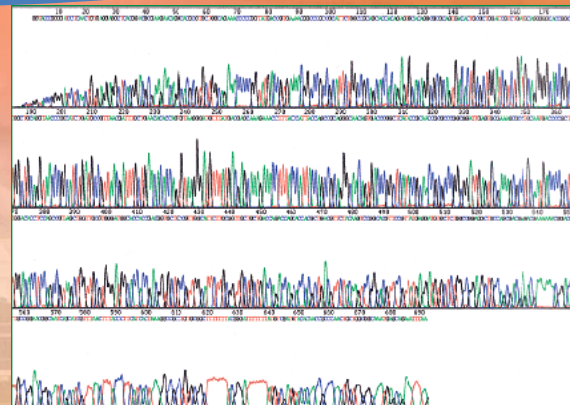


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- Background
  - Current Diagnostic Technique
- Proposed Methods
- Results & Discussion
- Conclusion and Future Works



## • Conventional Diagnostic Methods



Below is a summary of your recent labs:

• Cholesterol:	168	Goal <200
• HDL "good" Cholesterol:	46	Goal >40
• LDL "bad" Cholesterol:	86	Goal <160
• Triglycerides:	182	Goal <150

Interpretation: Cholesterol looks good.

Sodium:	138	Normal 135-148
Potassium:	4.8	Normal 3.5-5.5
Chloride:	105	Normal: 96-109
CO <sub>2</sub> :	24	Normal 20-32
BUN:	18	Normal: 5-26
Creatinine:	1.11	Normal 0.5-1.5
Glucose:	89	Normal 65-115
Calcium:	9.6	Normal 8.5-10.6

Summary: Electrolytes and kidney function are normal.

White blood cells:	7.4	Normal 3.5-10
Hemoglobin:	11.7	Normal 13-17
Hematocrit:	34.1	Normal: 38.5-52
Platelets:	339	Normal: 150-450

Interpretation: Mild anemia.



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- Conventional Diagnostic Methods
  - Body fluid (saliva, blood, urine) is taken by a trained medical person using specific equipments in clinical lab
  - Sample is further prepared using special protocol by trained medical person in clinical lab
  - Sample is analysed using special equipments: PCR, stained microscopy, etc.
  - Results are sent to the General Practitioner or Family Doctor

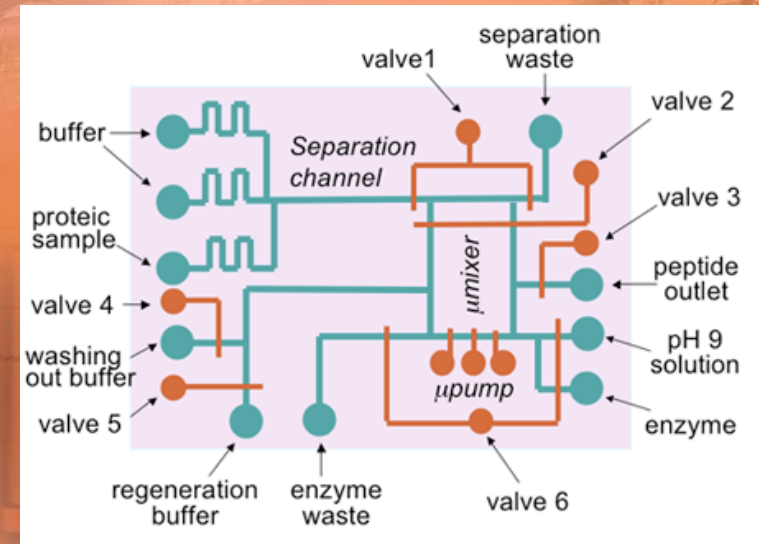
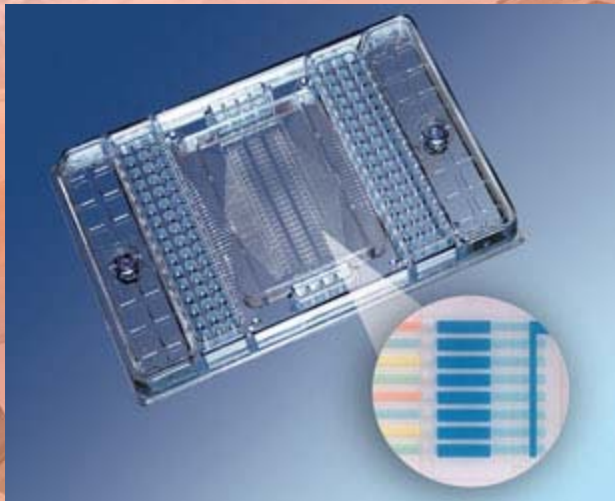




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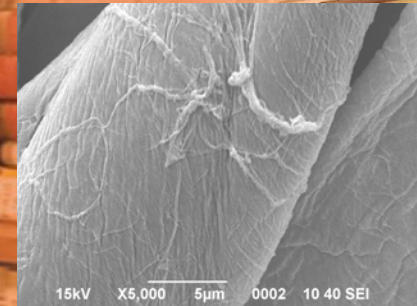
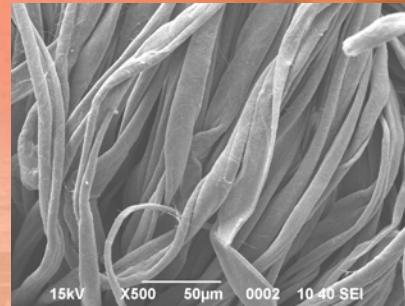
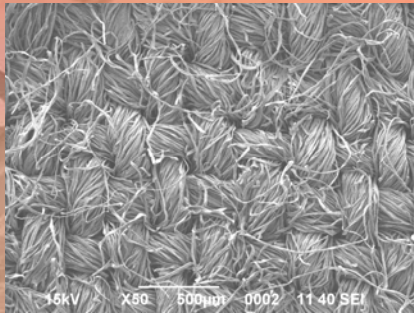
- Conventional Diagnostic Methods
  - Expensive
  - Taking long time to get diagnostic result
  - Tedious and cumbersome
  - Early detection of diseases is rare; thus more for curative rather than preventive medicine
  - Cannot be used for semi real-time / semi continuous patient condition monitoring

- **Microfluidics:** the manipulation of fluids in small volume at low Reynolds number (laminar flow) → **LAB ON A CHIP**





- **Cloth / Textile material** as cheap material platform for microfluidic device:
  - Gaps between the woven threads act as microfluidic channel
  - Pores in line shape between the fibres in a single threads also act as micro-/nano-fluidic channels





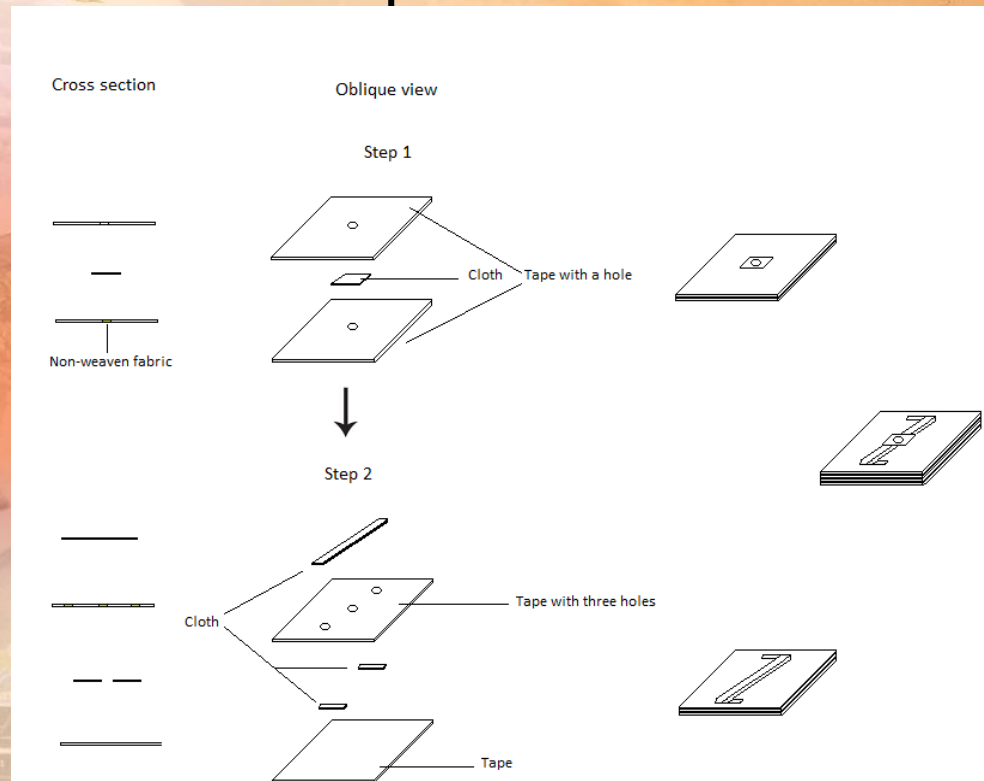


- **Batik** as an indigenous microfluidic fabrication technology





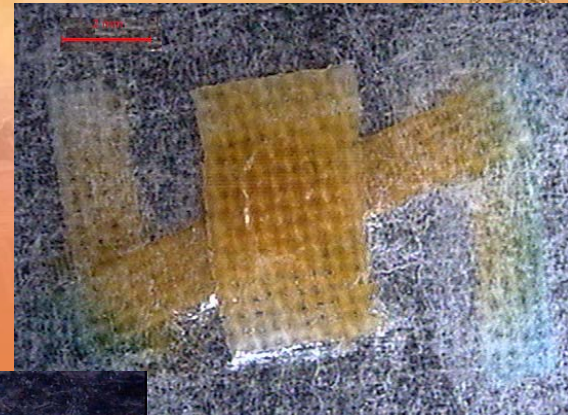
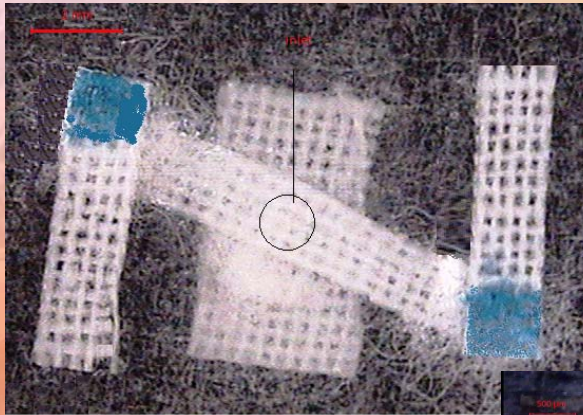
- Cloth Microfluidic device by stacking cut cloth and double side adhesive tape





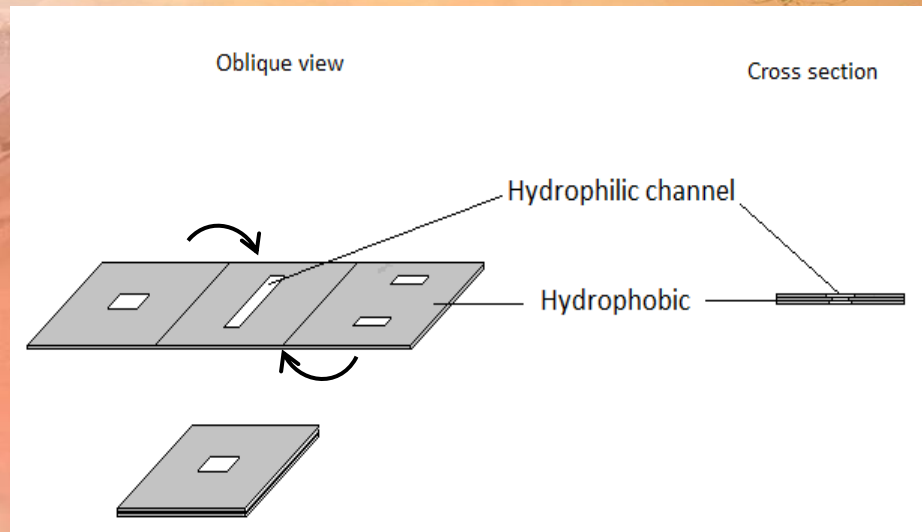
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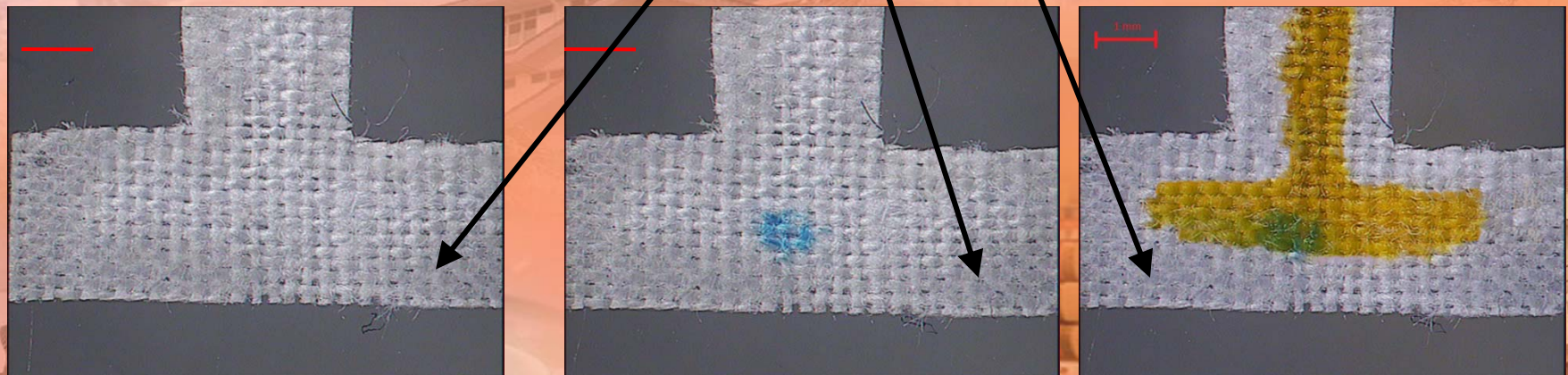
- Cloth Microfluidic device by batik-inspired wax patterning





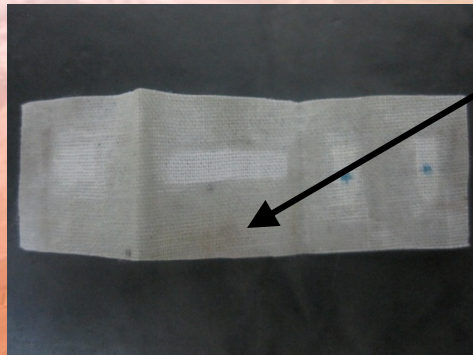
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Wax-hydrophobic resist

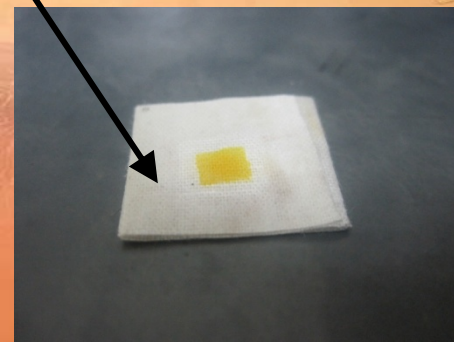




- Cloth Microfluidic device by batik-inspired wax patterning

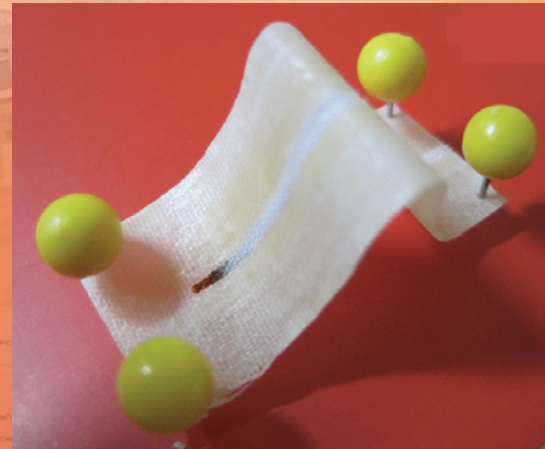
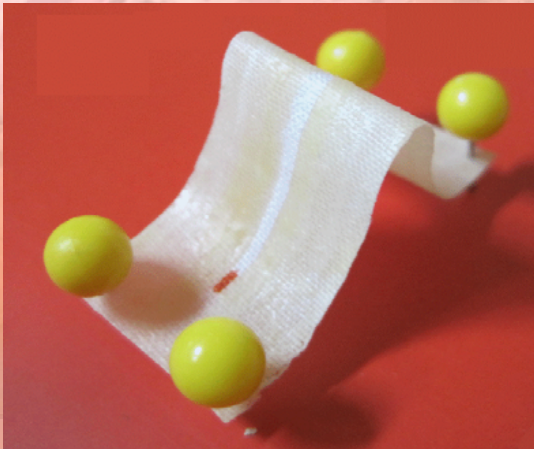


Wax-hydrophobic resist





- Flexible Microfluidic Cloth-based Analytical Device ( $\mu$ CAD)







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- We have proposed and shown the use of cotton cloth as a novel low-cost platform for microfluidic manipulation
- We have shown two different fabrication methods: cut and stack, wax-pattern and fold
- We have shown 2-D and 3-D microfluidic devices for diffusion-dominated mixing
- We have also shown the use of cloth microfluidic device as a new flexible bioanalytical platform



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- Design and fabrication of cloth-based microfluidic device for more complex bio-assays: ELISA, ...
- Integration as wearable device
- A novel platform for cell culture and tissue engineering → tissue on cloth-chip with applications e.g. drug screening, toxicity test, diagnostics, etc.