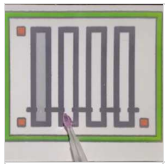

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Paper Microfluidic Chip Fabrication via Wax Printing

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ABSTRACT

This protocol will guide you through the process of paper microfluidic chip preparation via wax printing technique. This protocol does not include instruction on how to design the microfluidic chip. The authors suggest designing in SolidWorks, creating a SolidWorks drawing of the design, and saving as PDF before printing.

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MATERIALS TEXT

- 70% Ethanol spray bottle
- Nitrocellulose membrane (Sartorius CN95)
- Hot plate

SAFETY WARNINGS

Always wear gloves when handling nitrocellulose membrane. Nitrocellulose is highly flammable, keep away from open flames or excessive heat sources.

BEFORE STARTING

Have chip design prepared for printing.

Paper chip preparation 5m

Prepare the desired number of ~3 x 8 inches nitrocellulose (NC) membrane (Sartorius CN95) by cutting from the stock

1 paper roll (8 inches long).

- Once finished cutting all the desired number of NC membrane, ALWAYS place the stock paper roll back to the plastic bag and store it in the drawer to prevent dust formation on the membrane.
- **ALWAYS** wear gloves when handling the NC membrane to prevent the oil from our hands from depositing NC membrane.

2 Print the chip designs from the file on a ~3 x 8 inches NC membrane via wax printer.

- Within the printing command window, select the advanced setting and change a paper type to "Japanese envelope chou#4" which size matches our NC membrane. Select the scale with 100% to maintain the correct chip dimension. DO NOT select "fit to printable area" since it will shrink the chip design to a smaller dimension.
- Always make sure you select a paper type having the size that matches with the physical paper that you want to print on. And adjust the "Tray 1" on a wax printer to match with your paper width.
- Wax printer will print the wax on the opposite side of the paper that you place facing up on the tray. Therefore, place the plastic back side facing up on "Tray 1" for printing.
- Sometimes the printer may have difficulty in feeding in the paper, you might have to hold the paper and help feed to the printer roller.

3 Re-flow the printed wax on NC membrane by placing the NC membrane on a hot plate set at **120 °C** for **00:02:00** to **00:03:00** . Prevent the membrane from curling up while heating by placing foil on top of the membrane, and place the metal weight on top of the foil. 5m

- Ensure the wax has completely re-flowed by looking at the plastic backing of the membrane and making sure that printed wax has homogeneously distributed along the printed area. If wax is not completely re-flowed through the paper depth, it will result in liquid leaking out of the main flow channel.
- Highly recommend cleaning the foil between each chip re-flow by wiping the foil (on the side that is placed on top of the paper chip) with 70% ethanol and wait until it completely dries before placing on the next chip.

Leaving the paper on hot plate for too long may result in burning the plastic backing and NC membrane which will change the membrane's pore structure, which subsequently alters the flow characteristics and results.

4 Once the wax is completely re-flowed, cut the printed chip design to an individual chip and store in the petri dish covered

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with parafilm at **Room temperature** prior to the experiment.

- DO NOT stack the NC membrane together while they are still hot from a hot plate as it may result in leaving wax debris in the flow channel.
- When cutting into an individual chip, leave an extra 5 mm white area beyond and around the green edge for a paper chip holder.

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