Electronic Supplementary Material (ESI) for Lab on a Chip.

Supplementary Information for

A frugal microfluidic pump

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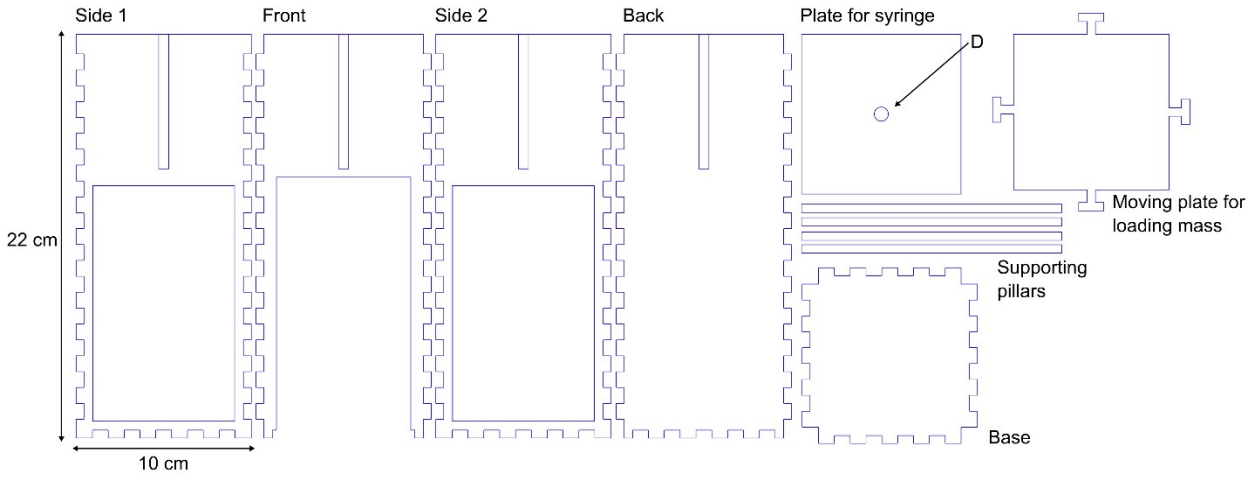
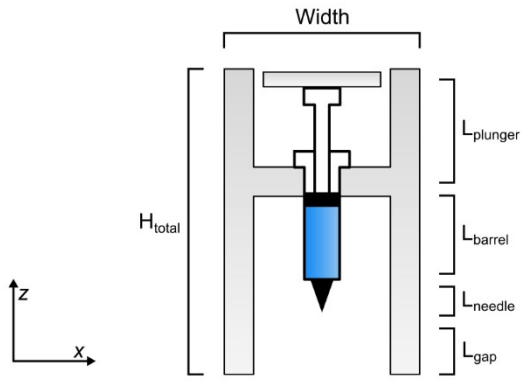
Supplementary Figure S1: CAD Drawing for laser-cut fabrication of the frugal microfluidic pump



D = 8 mm (1 mL syringe), 10.6 mm (2.5/3 mL syringe), 18.2 mm (5 mL syringe)

Supplementary Figure S2: Design principles for the frugal microfluidic pump dimensions



The syringe holder size can be adjusted depending on the required application. The total height (H_{total}) is one of the major determining factors. To choose the total height, we take into account the length of the syringe plunger ($L_{plunger}$), the length of the syringe barrel (L_{barrel}), the length of the needle (L_{needle}), and the gap length (L_{gap}) as a room to spare for the connection. For syringes we examined here, on average, $L_{plunger}$ and L_{barrel} were around 6 cm each. The L_{needle} was 2 cm. The L_{gap} can be varied for ease of testing (connecting and reconnecting tubes), but we suggest a minimum gap of 2 cm. Therefore, the minimum H_{total} for the frugal microfluidic system is 16 cm. The widths (in *x* and *y* directions) of the syringe holder at least need to be more than 1/3 of the H_{total} to ensure the stability of the apparatus. Therefore, the smallest width for the aforementioned H_{total} is at least 6 cm. Another aspect to account for deciding the width is the loading mass dimension. If the intended application requires multiple masses loaded onto the system, the width can be increased accordingly. Overall, we recommend minimum dimension of the frugal microfluidic pump is 6 cm × 6 cm × 16 cm.

Supplementary Table S1: Syringe inner diameter dimensions

No.	Syringe size	Syringe material	Syringe brand	Inner diameter (mm)
1	1 mL	Plastic	BD	4.78
2	3 mL	Plastic	BD	8.66
3	5 mL	Plastic	BD	12.07
4	1 mL	Glass	Hamilton	4.61
5	2.5 mL	Glass	Hamilton	7.29
6	5 mL	Glass	Hamilton	10.30

Supplementary Section 1: Materials cost for the frugal microfluidic pump

The majority of the material cost comes from the syringe holder. In this paper, we used an acrylic (PMMA) sheet because of its availability, ease of manufacturability using laser cut machine, and decent chemical resistance. Other material candidates that we deemed suitable are a thin plywood sheet and MDF board which are rigid and sturdy to hold the loading mass. We suggest choosing materials that are locally available and inexpensive. For the loading mass, the most affordable option is by opting for a plastic cup filled with water. A calibrated weight balance set is generally more reliable for precise control of the frugal microfluidic pump. Both plastic syringes and glass syringes can be used for the frugal microfluidic pump. The cost of the syringe varied for different brands. The overall minimum cost for the frugal microfluidic pump using an acrylic syringe holder, a plastic cup as the loading mass, and a plastic syringe is under US$ 2.

No.	Material	Amount (Unit)	Use	Cost
1	Acrylic sheet	1500 (cm^2)	Syringe holder	US$ 1 – 5
2	Plastic cup	1 (pc)	Loading mass	US$ 0.01
3	Balance weight	1 (set)	Loading mass	US$ 5 – 10
4	Plastic syringe	1 (pc)	Sample reservoir	US$ 0.1
5	Glass syringe	1 (pc)	Sample reservoir	US$ 1 – 15