

## **Supplemental Materials and methods:**

### **Chip fabrication**

The chips contained two functional PDMS layers assembled in a push up geometry: the top flow layer where the biological material is processed and the bottom control layer actuating the elastomeric valves.

The flow layer was cast on a two layers mould and the control layer was spun at 1900rpm onto a three layers mould. The moulds characteristics are described in Table 1.

The purpose of the dummy layer (C.1) was to even the spun PDMS height by homogenizing the wetting properties of the wafer, especially in high channel density areas.

The hydration layer (C.2) defines small channels that sit below the reaction chambers. Since PDMS is gas permeable, water evaporates over time. These hydrating channels are connected to the control lines and remain under pressure during the reaction, providing a constant water supply to equilibrate the loss.

The valves are designed by placing a control channel of 100 $\mu$ m or more below a flow channel (100 $\mu$ m width). The membrane closing the valve has a thickness of about 10 $\mu$ m leading to an actuation pressure for a 100x100 $\mu$ m geometry below 5 psi.

	Layer name	Layer colour	Material	Features	Profile	Width ( $\mu\text{m}$ )	Height ( $\mu\text{m}$ )
Flow Mould	F.1.Flow	Dark Blue	SPR 2207	Channels	Rounded	100	7
	F.2.Chambers	Pink	SU8 2025	Chambers	Rectangular	200- 1400	25
Control Mould	C.1.Dummy	-	SU8 2005	Blank	-	-	5
	C.2.Hydration	Light blue	SU8 2015	Channels	Rectangular	25	10
	C.3.Control	red	SU8 2025	Channels	Rectangular	25-200	25

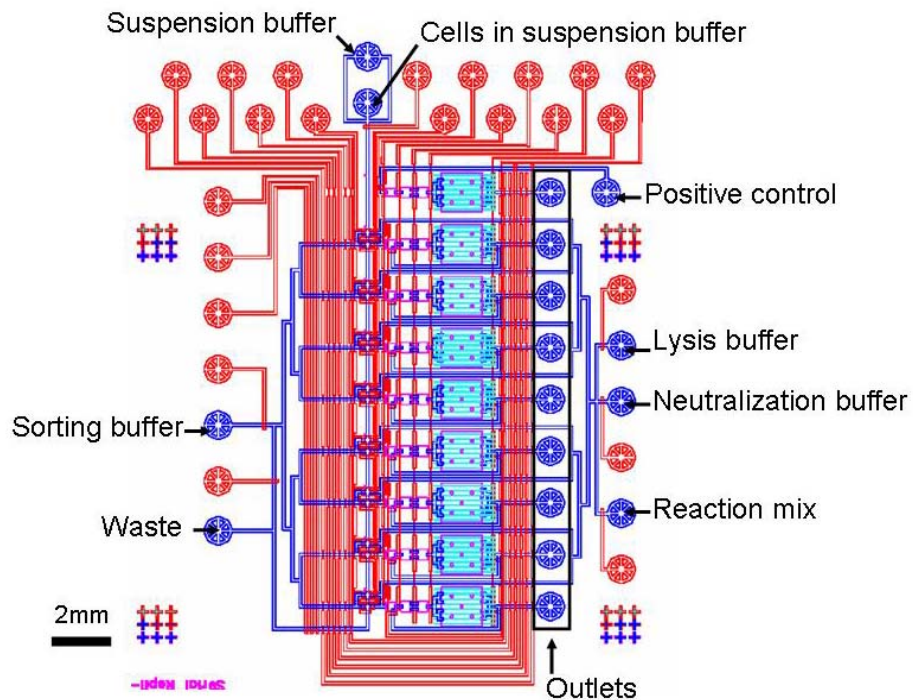


Figure1: Chip layout including the different flow inlet and outlet description. Each colour represents a different layer (see Table 1).