

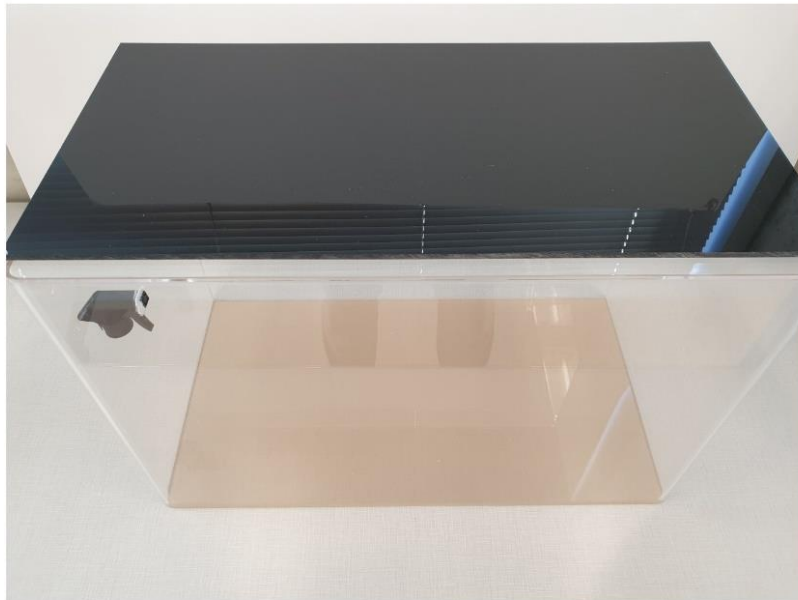
# Supplementary Figures

## **Direct capture and smartphone quantification of airborne SARS-CoV-2 on a paper microfluidic chip**

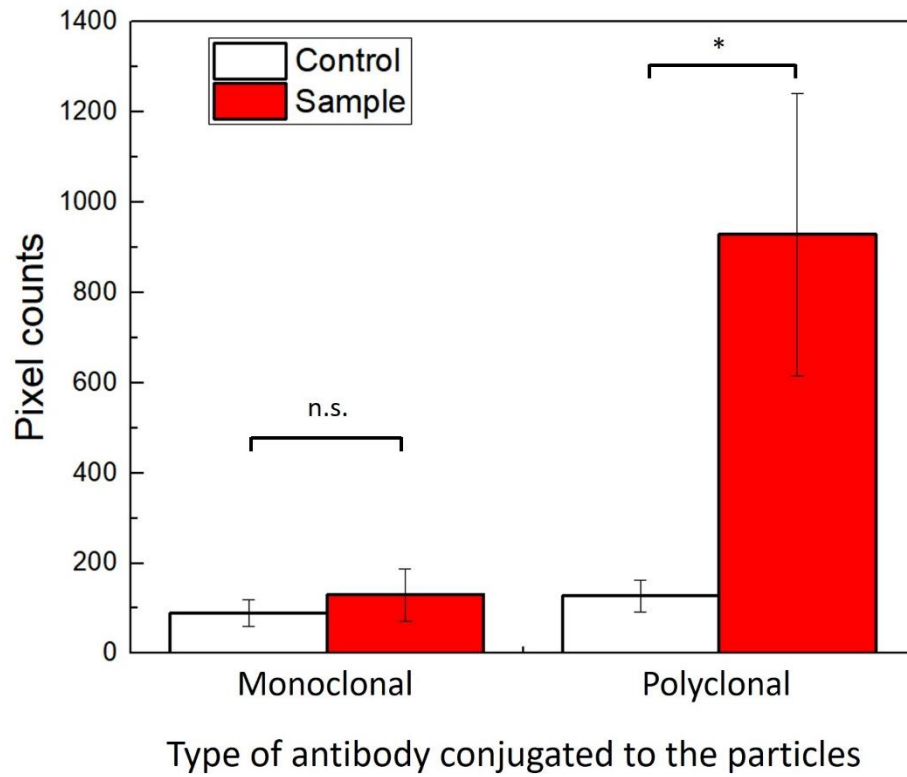
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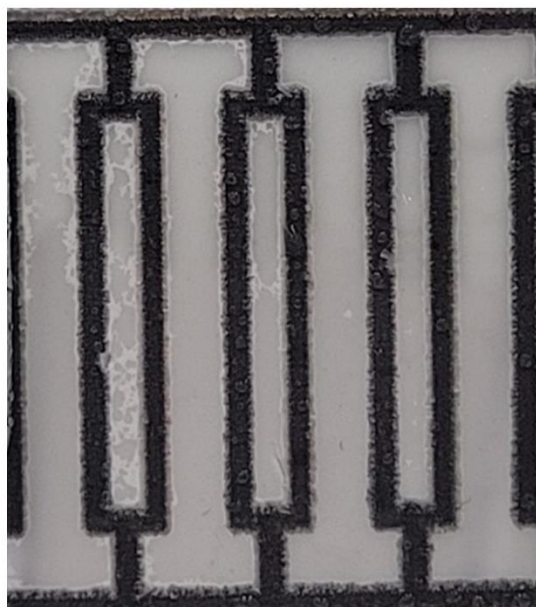


**Supplementary Figure S1.** Photographs of the chamber used in this work.

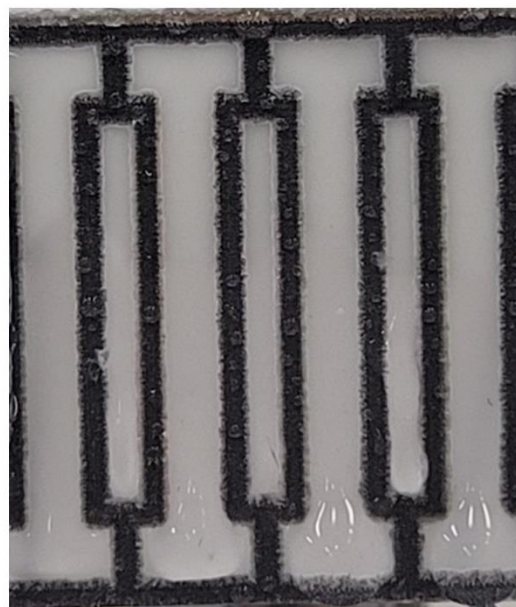


**Supplementary Figure S2.** Particle aggregation assays on paper microfluidic chips using monoclonal and polyclonal antibodies.

(a) Two-times spray

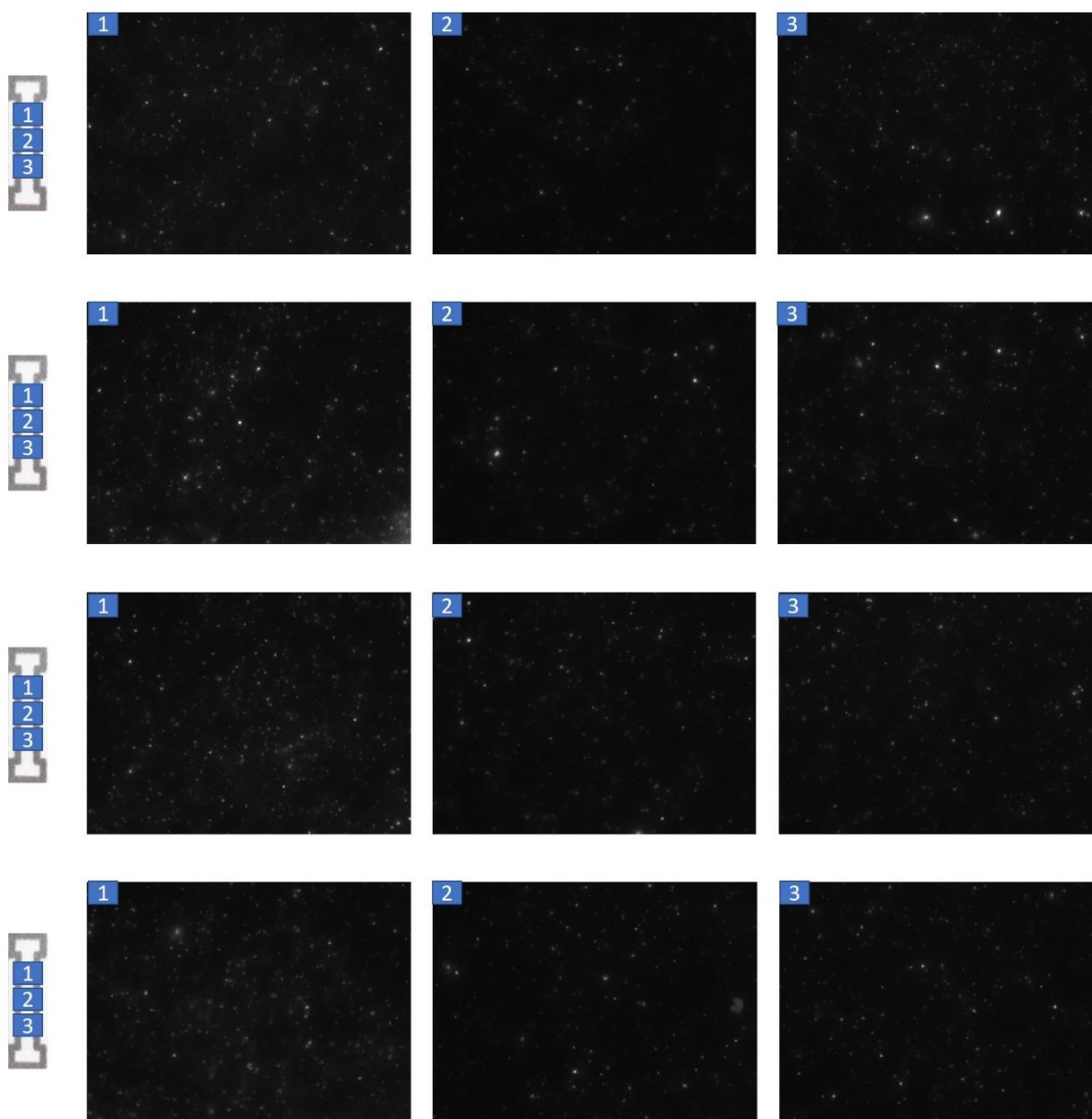


(b) Five-times spray



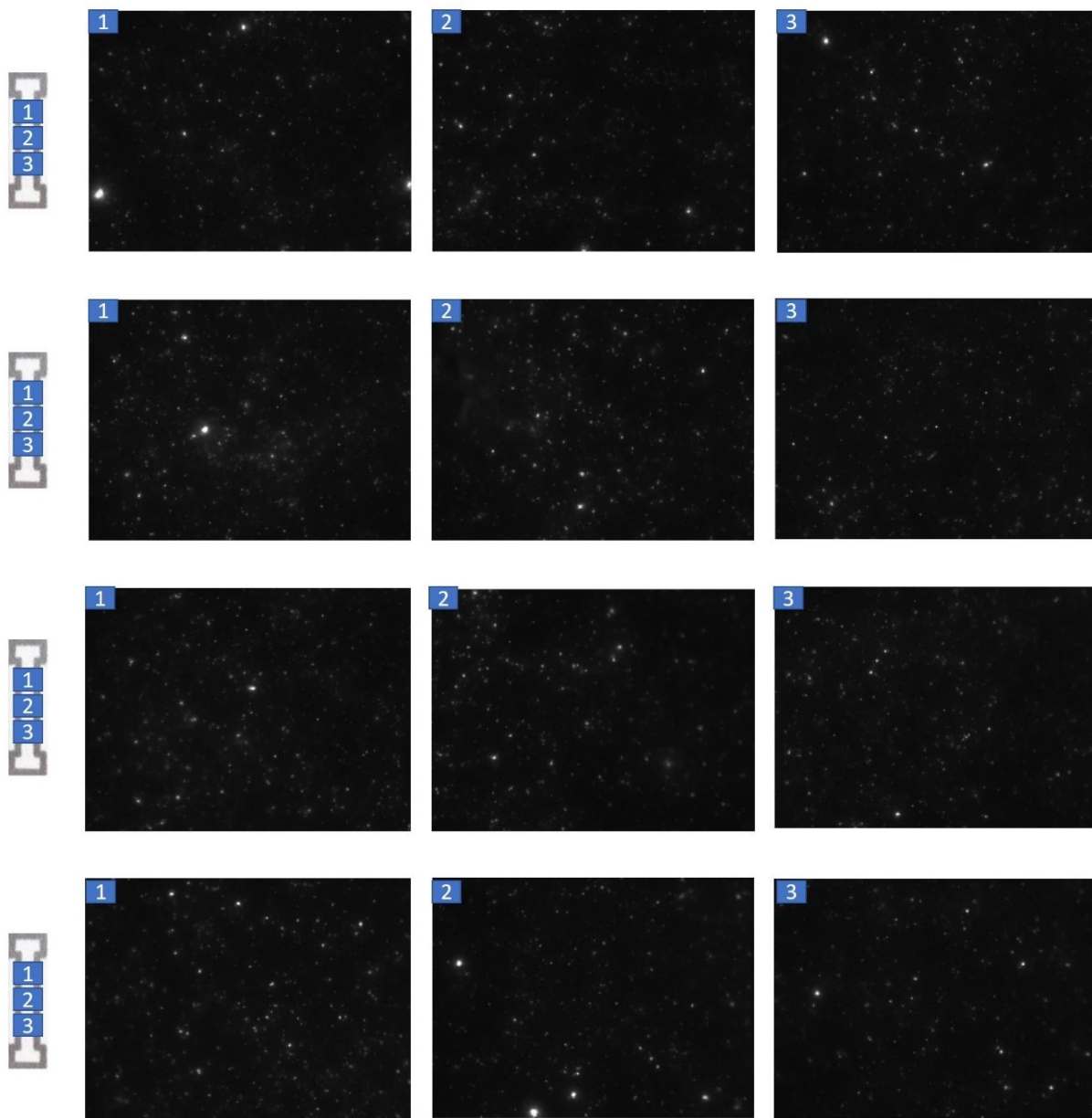
**Supplementary Figure S3.** Photographs of paper microfluidic chips after two-times and five-times spraying. Liquids are falling off the chip with five-times spraying.

(a) Control



**Supplementary Figure S4.** Raw images from a benchtop fluorescence microscope. Three different areas of a single channel were imaged for each assay. Paper microfluidic chip was placed at a 6-inch distance.

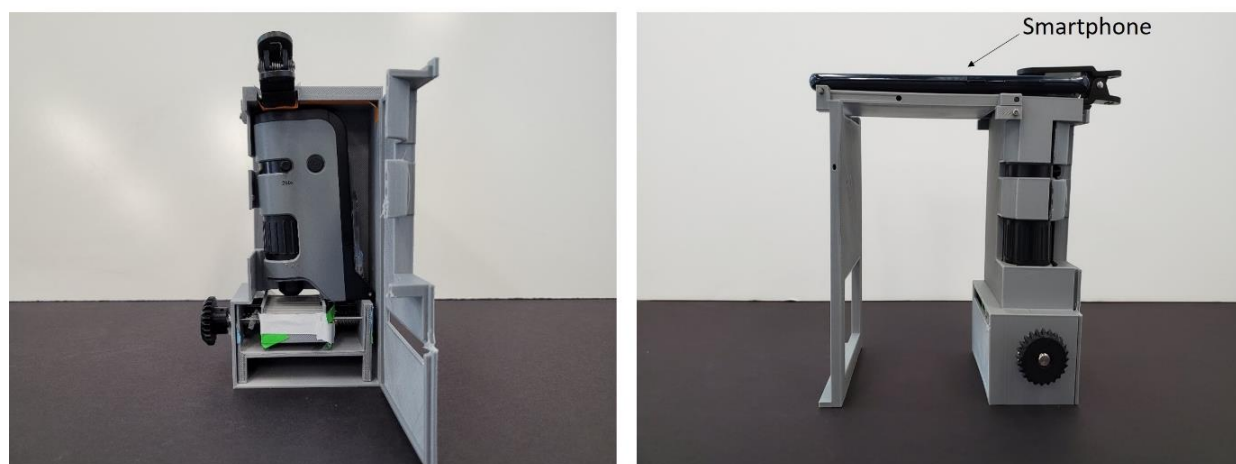
(b) Sample



Supplementary Figure S4. (Continued)



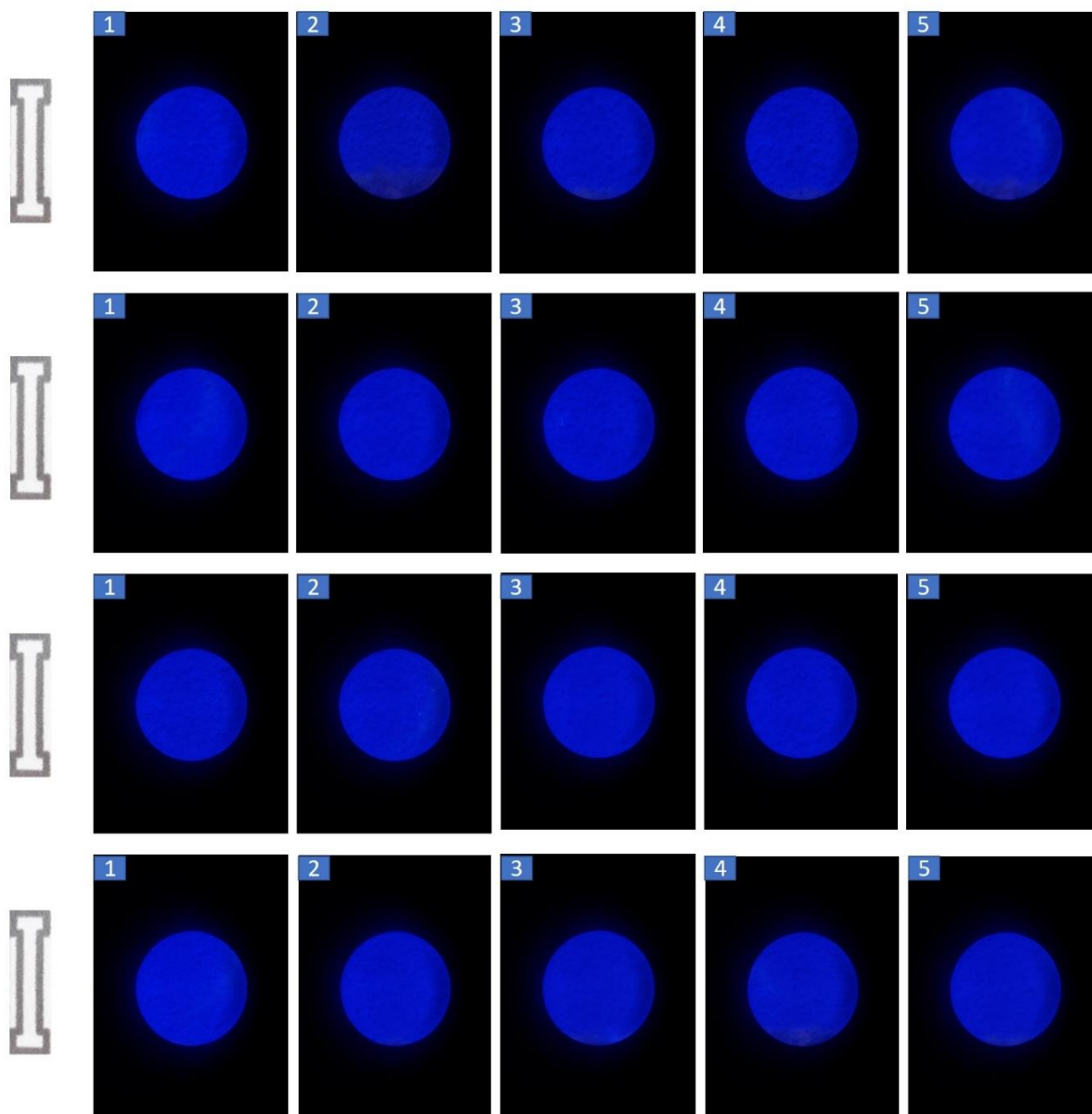
(b)



**Supplementary Figure S5.** (a) The light path diagram of a smartphone-based fluorescence microscope.

(b) Photographs of a smartphone-based fluorescence microscope.

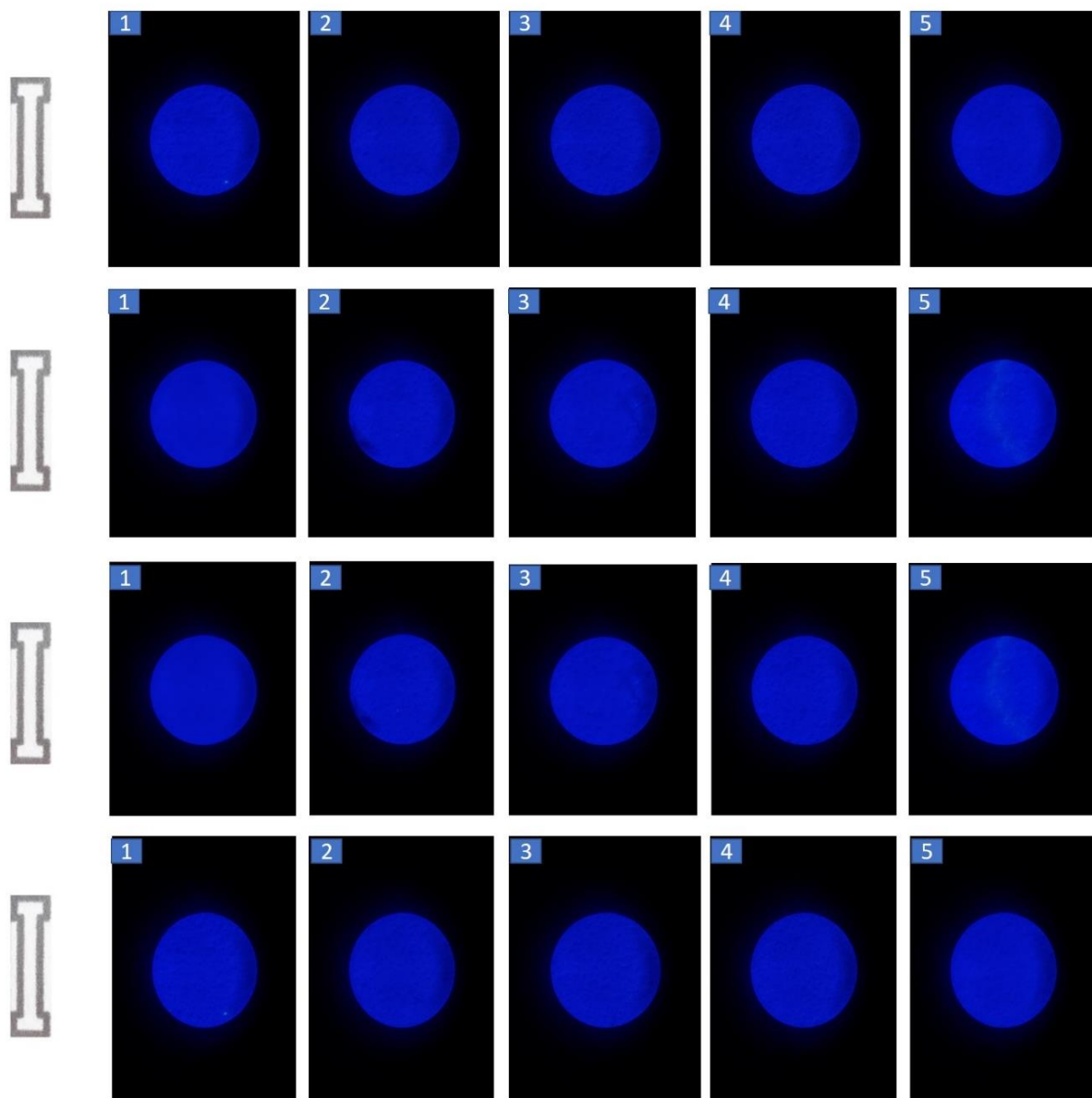
(a) Control



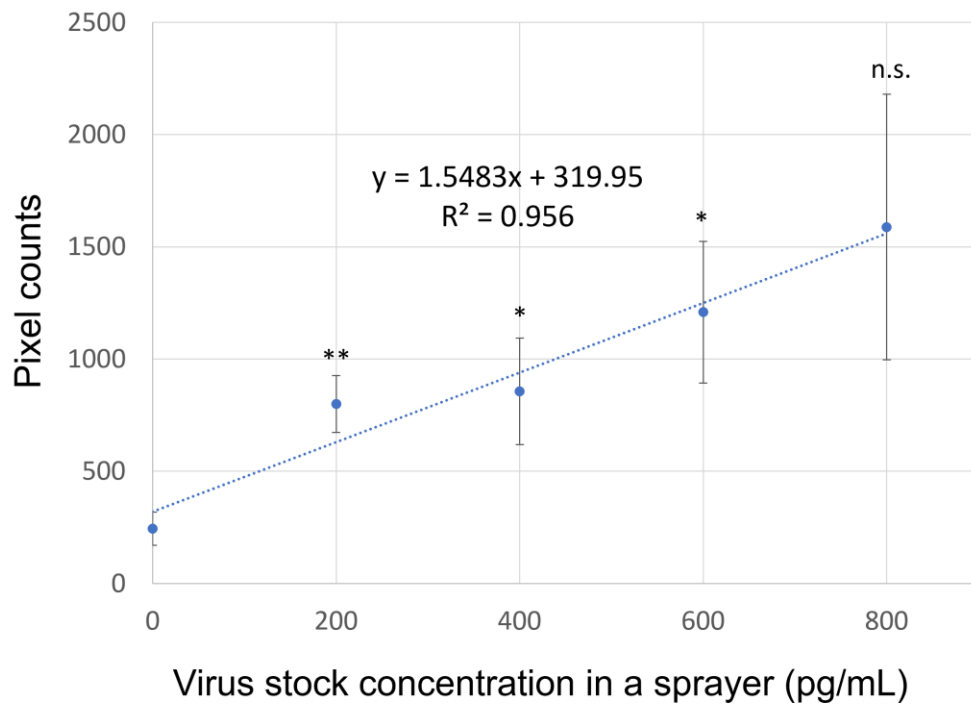
**Supplementary Figure S6.** Raw images from a smartphone-based fluorescence microscope. Five different areas of a single channel were imaged for each assay. Paper microfluidic chip was placed at a 6-inch distance.



(b) Sample

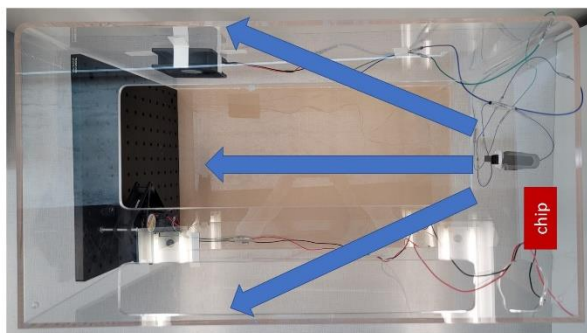


Supplementary Figure S6. (Continued)

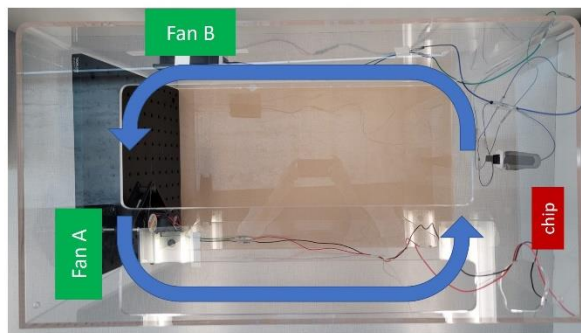


**Supplementary Figure S7.** Standard curve to demonstrate the quantification capability. Pixel counts are plotted against the virus stock concentration in a sprayer. The distance of the paper microfluidic chip was fixed at 6 inches, and the number of sprays was fixed to two times.  $n = 4$ ; \* denotes  $p \leq 0.05$ ; \*\* denotes  $p \leq 0.01$ , in comparison with 0 pg/mL data.

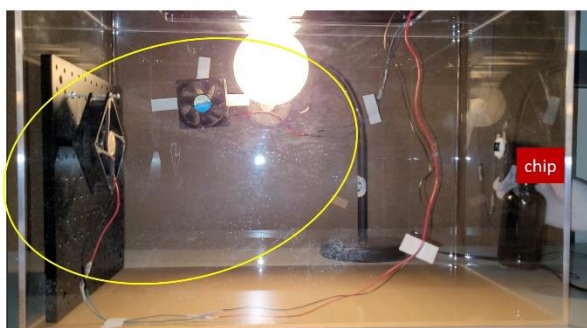
Fans turned off (top view)



Fans turned on (top view)



Fans turned off (side view)

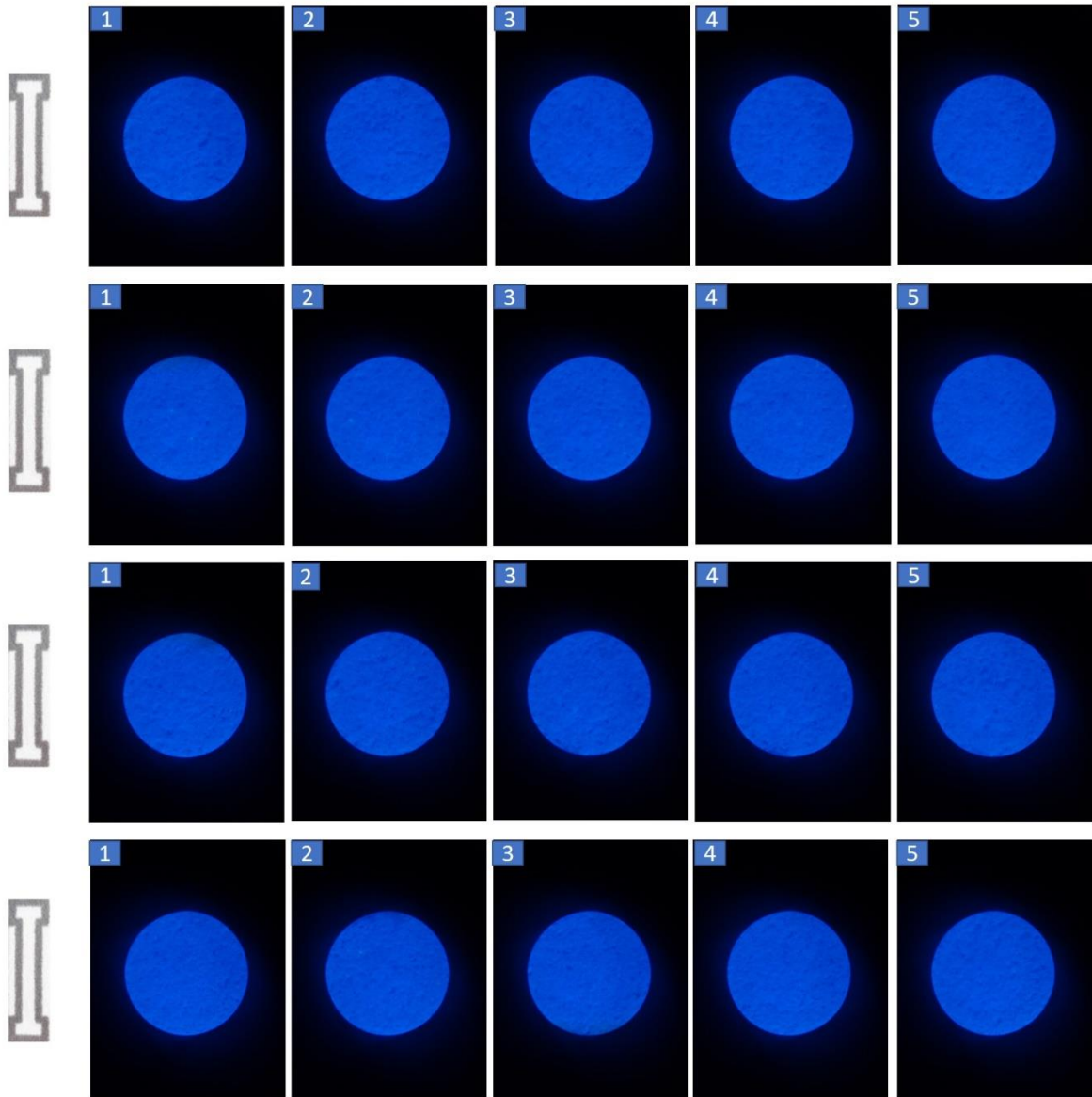


Fans turned on (side view)



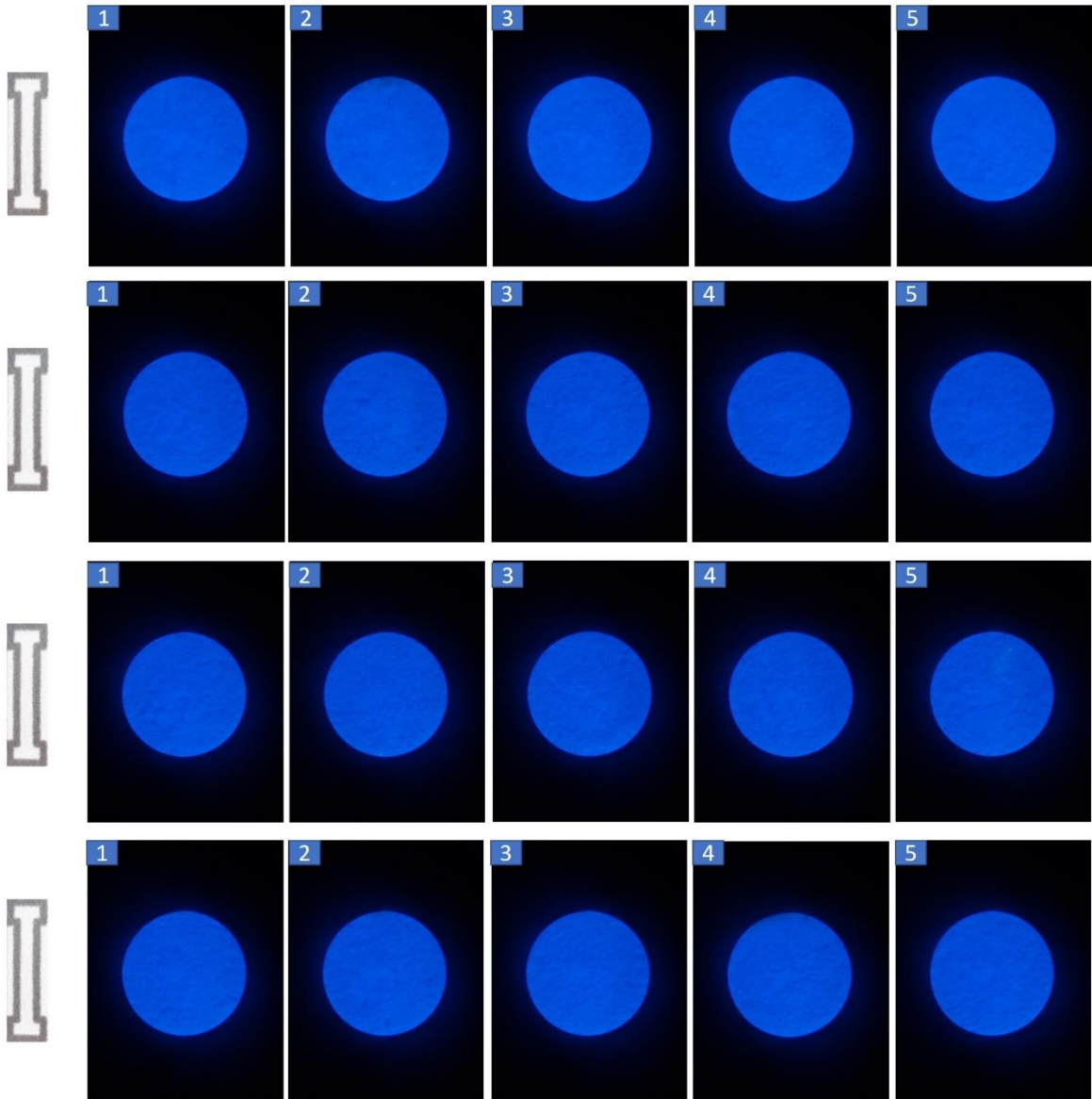
**Supplementary Figure S8.** Droplets and aerosols were circulated through the chamber using two fans. Without fans, droplets and aerosols are sprayed generally from right to left, where the larger droplets mainly were found along the right-to-left linear path. With fans, droplets and aerosols are circulated in one direction, where the larger droplets could be found across the entire chamber. (Larger droplets can be identified from the bottom images, circled in yellow.)

(a) No virus, no fan



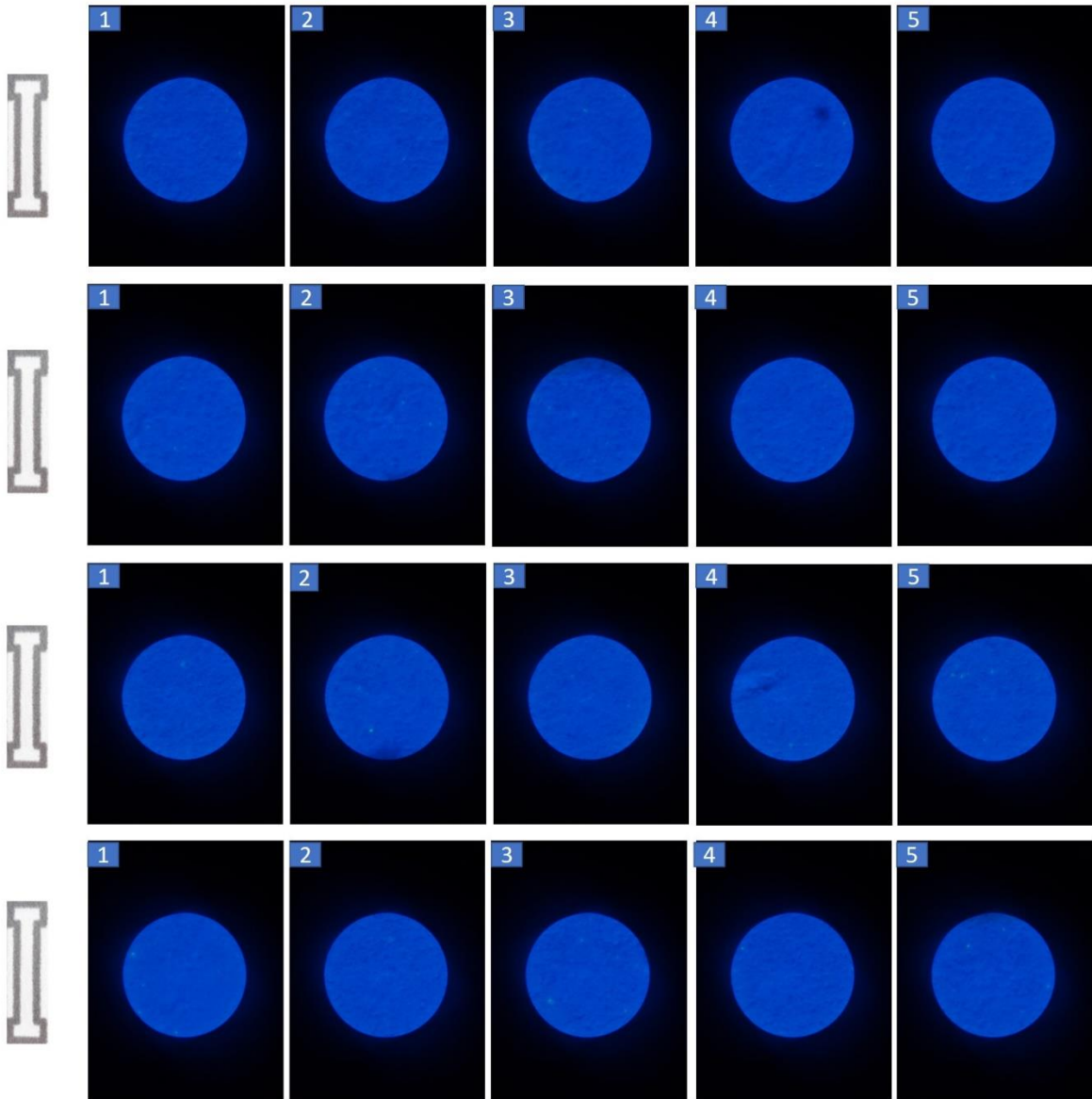
**Supplementary Figure S9.** Raw images from a smartphone-based fluorescence microscope in Fig. 3C. Five different areas of a single channel were imaged for each assay.

(b) No virus, fan



Supplementary Figure S9. (Continued)

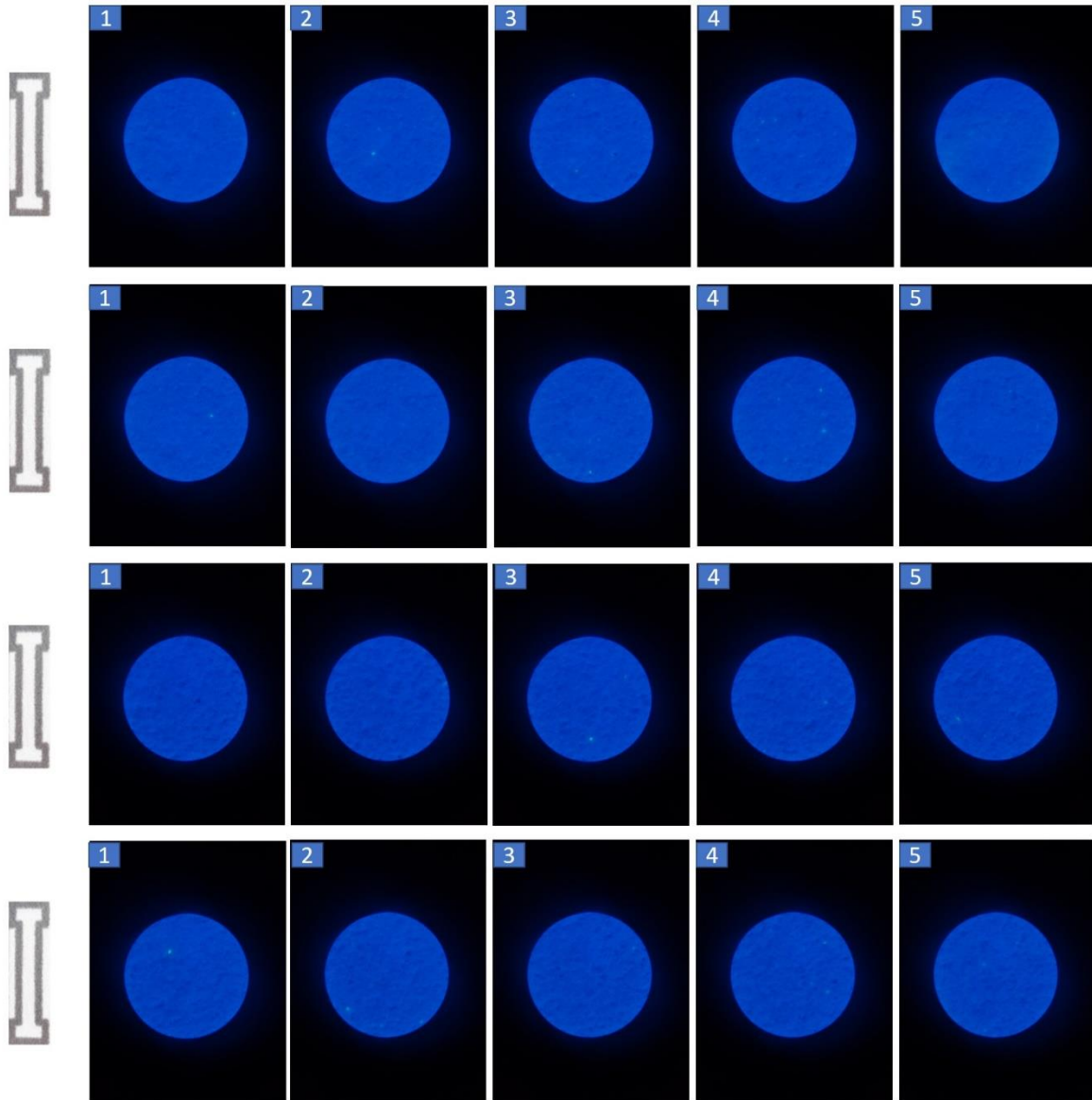
(c) Virus, no fan



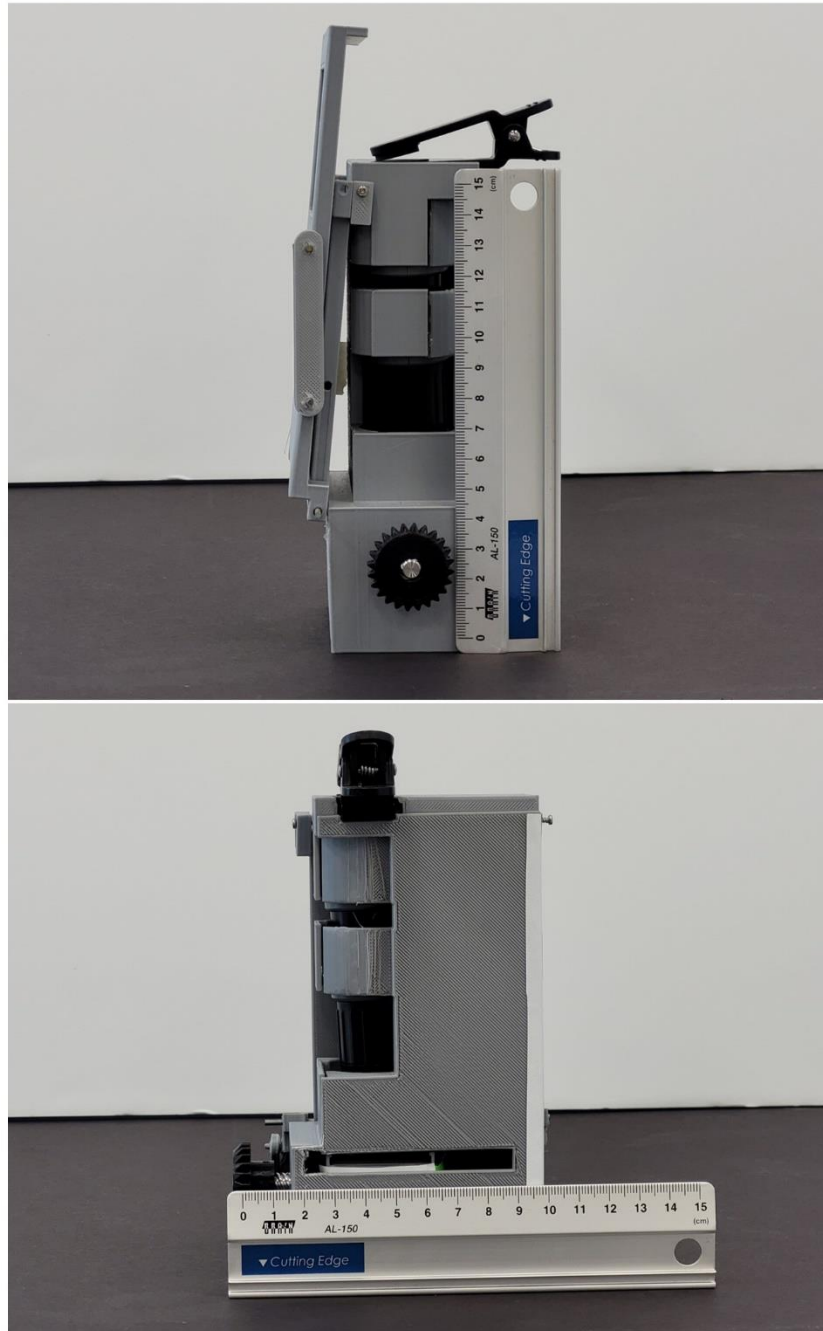
Supplementary Figure S9. (Continued)



(d) Virus, fan



Supplementary Figure S9. (Continued)



**Supplementary Figure S10.** The smartphone-based fluorescence microscope is foldable, whose dimension is 10 cm x 5 cm x 15 cm.



**Supplementary Table S1.** Cost analysis of a smartphone-based fluorescence microscope (all in US dollars).

<b>Material</b>	<b>Catalog number</b>	<b>Amount</b>	<b>Cost/unit</b>	<b>Cost</b>
PETG	Overture OVPETG175	450 g	\$18.99/1000 g	\$7.60
460 nm LED	Kingbright WP7113QBC/G	1 pc	\$5.75/10 pcs	\$0.58
White LED	CHANZON HM-13052	1 pc	\$6.67/100 pcs	\$0.07
1 k $\Omega$ resistor	E-Projects EP5121K00	1 pc	\$6.31/100 pcs	\$0.06
Color filter films	Edmund Optics #1872	2 pcs	\$17.50/200 pcs	\$0.02
Microscope attachment	Carson MP-250	1 pc	\$17.99/1 pc	\$18.00
2 mm metal rods	uxcell a13090200ux0053	3 pcs	\$10.19/10 pcs	\$3.06
T8 lead screw & copper nut	uxcell a19032000ux0497	1 pc	\$15.04/2 pcs	\$7.52
Mini rectangular magnet	magpross magp7	2 pcs	\$9.90/40 pcs	\$0.50
Slide switches	WOWOONE SS-12D10	2 pcs	\$6.99/20 pcs	\$0.70
9 V rechargeable battery	EBL EBL-9V	1 pc	\$16.99/4 pcs	\$4.25
Mini breadboard	SparkFun PRT-12702	1 pc	\$2.95/1 pc	\$2.95
Electrical wire (22 AWG)	SparkFun PRT-08022	10 in	\$2.50/25 in	\$1.00
M3 screw and nut set	SZHKM 0631105843027	4 pcs	\$14.99/500 pcs	\$0.12
<b>Total cost per device</b>				<b>\$46.40</b>