

## RESEARCH ARTICLE

# Development of a low-cost quad-extrusion 3D bioprinting system for multi-material tissue constructs

## Supplementary File

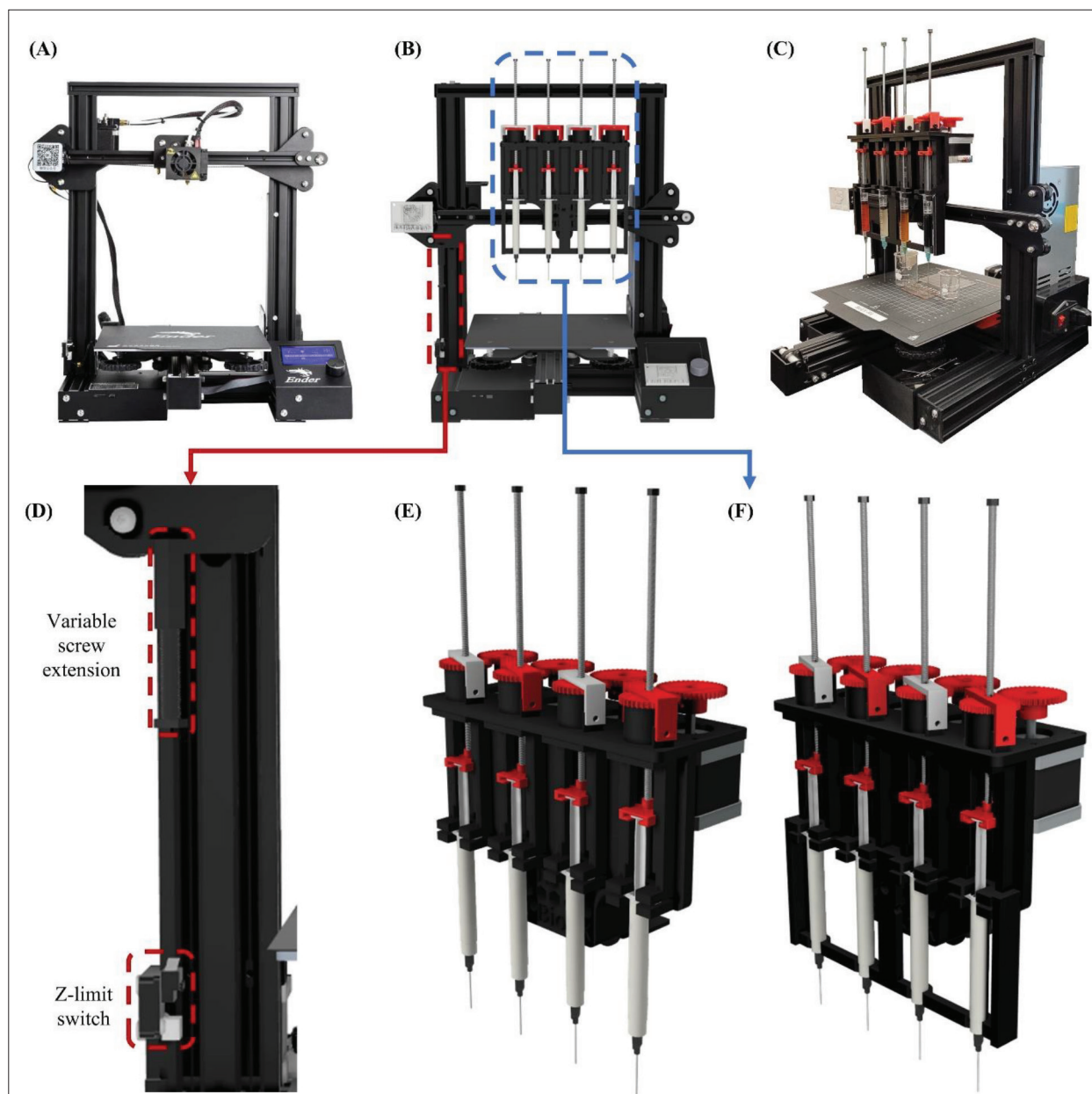
**Table S1. An overview of both commercial bioprinters currently available on the market and relevant research endeavors**

Product	Manufacturer	Print volume	Extruders	Cost (US\$)
BioV1	REGEMAT3D	150 × 160 × 110 mm	3	~\$25k
Allevi 3	Allevi by 3D Systems	130 × 90 × 60 mm	3	~\$40k
BIO X	CELLINK	130 × 90 × 70 mm	3	~\$40k
LulzBot BIO	LulzBot	160 × 110 × 90 mm	1	~\$10k
ModiPrint	Shen <i>et al.</i> <sup>[26]a</sup>	600 × 600 × 700 mm <sup>b</sup>	4	~\$6k
Ultra-low-cost 3D Bioprinter	Kahl <i>et al.</i> <sup>[27]a</sup>	100 × 100 × 240 mm	1	~\$160
Low-cost bioprinter	Krige <i>et al.</i> <sup>[30]a</sup>	230 × 200 × 100 mm	3	~\$300 <sup>c</sup>
Nydus One Syringe Extruder (NOSE)	Bessler <i>et al.</i> <sup>[32]a</sup>	200 × 200 × 200 mm	1	~\$95 <sup>c</sup>

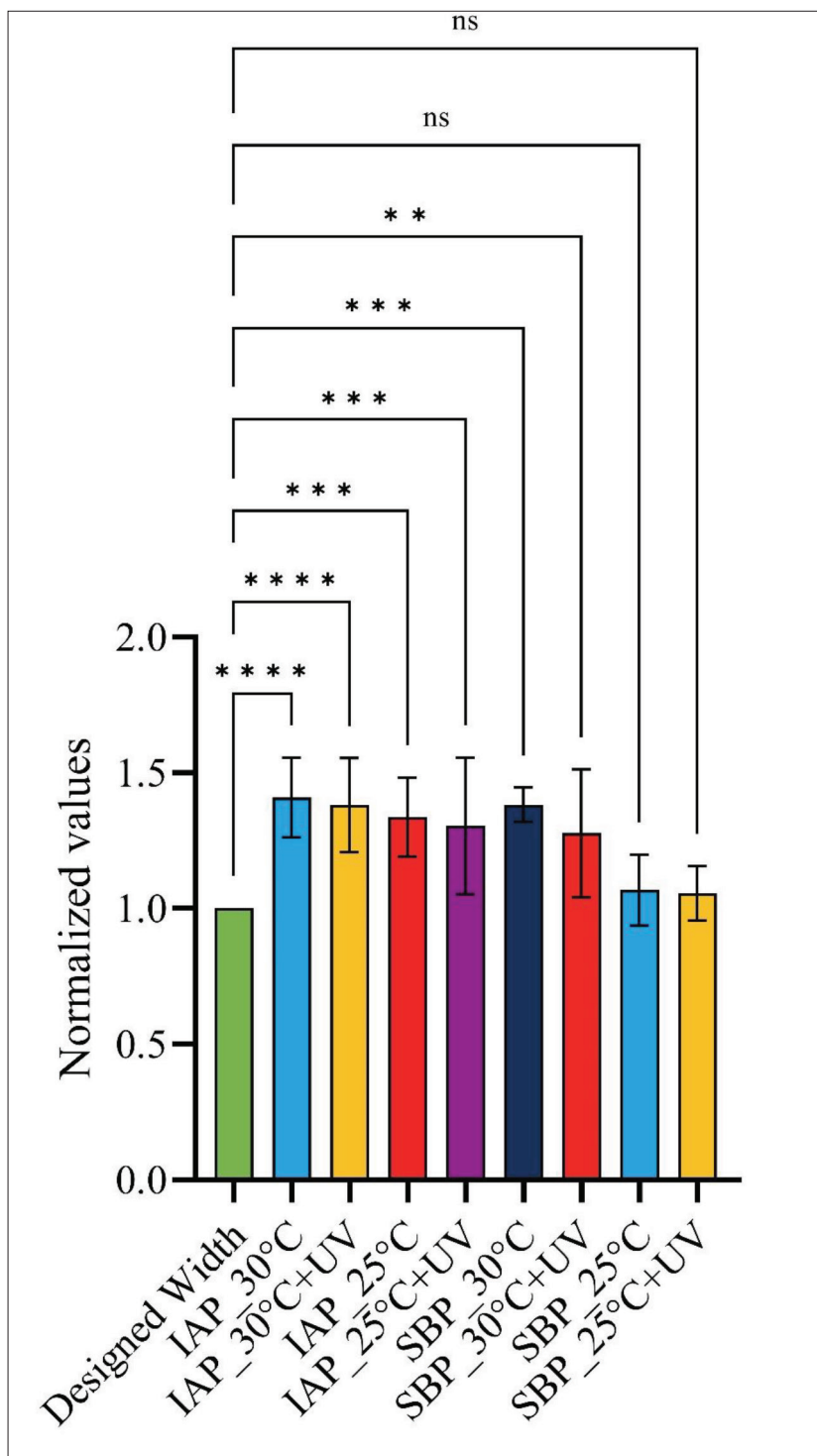
<sup>a</sup> Refer to the original references in the main article (<https://doi.org/10.36922/ijb.0159>).

<sup>b</sup> Total machine volume rather than printing volume as it is not clear from the research group.

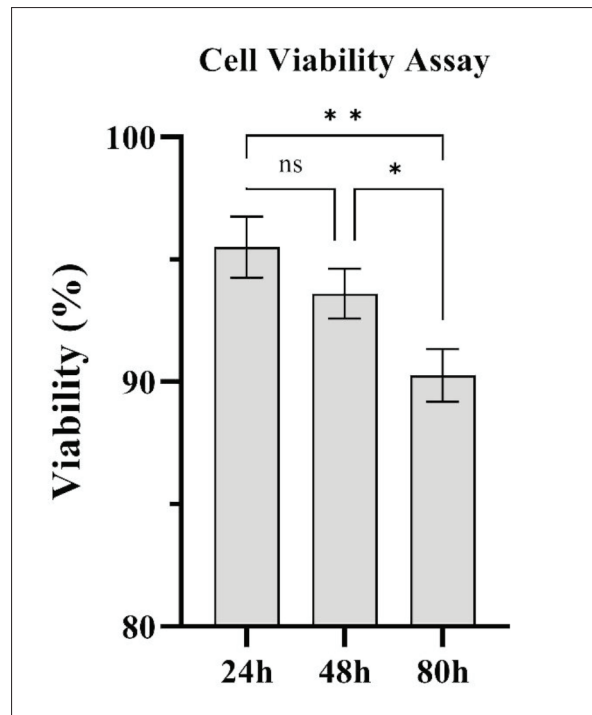
<sup>c</sup> Cost of modified extruder only; this cost is added to the cost of the Prusa i3 3D printer.



**Figure S1.** QEB components and development. (A) Original Creality Ender 3 Pro desktop 3D printer. (B) Final QEB 3D Cad model showing the modifications done on the Ender 3 Pro with the final QEH mounted on the printer. (C) Real photo of final QEB with 4 syringes mounted, containing different bioinks. (D) Variable screw extension for Z-limit switch for different needle length accommodation. (E) First QEH developed before the addition of the nozzle frame. (F) Final QEH with the added nozzle frame to maintain nozzle alignment.



**Figure S2.** Normalized strand width measurements compared to the designed width. Grids printed with in-air printing (IAP) and support bath printing (SBP), at 25°C and 30°C, with and without UV crosslinking are measured and normalized. Comparisons between each group and the designed width were statistically analyzed using one-way ANOVA (ns, not significant; \*  $p < 0.05$ ; \*\*  $p < 0.005$ ; \*\*\*  $p < 0.0005$ ; \*\*\*\*  $p < 0.00005$ ).



**Figure S3.** Cell viability of HTR-8 cells, printed in a grid structure, over a 3-day time course. (\*  $p < 0.05$ ; \*\*  $p < 0.005$ ).