Electronic Supplementary Material (ESI) for Soft Matter.

Electronic Supplementary Information to:

Ice modulatory effect of the polysaccharide FucoPol in directional freezing

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SI.1. Directional freezing stage

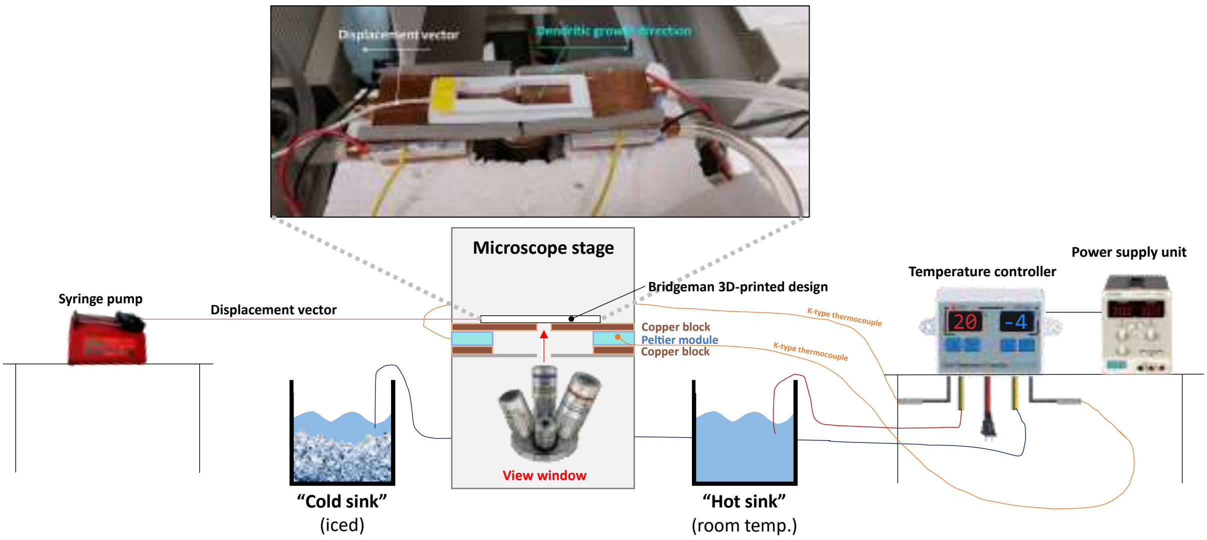

Figure SI.1. Complete directional freezing setup schematics. A power supply unit connected to a temperature controller measure the temperature of two water baths, of boundary temperatures. Then, the effective temperatures at the directional freezing stage are modulated by Peltier modules, connected to a controller by a K-type thermocouple, to establish a thermal gradient. To avoid thermal lag, the Bridgeman 3D-printed design is in direct contact with copper blocks to improve thermal conductivity. A syring pump is responsible for the displacement of the Bridgeman shape, the driving force for the liquid solution to generate unidirectional dendritic growth, by gradually exposing the sample holder to all slices of the thermal gradient. A 5 mm microscope view window exists, from which dendrite image acquisition was performed.

SI.2. 3D-cryobioprinting of FucoPol as proof-of-concept

Here we show that a 0.5 wt.% FucoPol solution, responsible for creating the highly symmetrical, aligned and shape-defined tubular dendrites could also be used as a biocompatible matrix. **Table SI.1** shows the optimal parameters acquired in a previously described 3D-cryobioprinter (*Bioprinting* **27** e00225 (2022)) while attempting to extrude a 0.5 wt.% FucoPol aqueous solution. **Figure SI.2** shows preliminary photographs of the 3D-cryobioprinted 0.5 wt.% FucoPol solution, before and after structural freezing. The photographs are not representative of what a final 2D waffle-like matrix would look like, but it does present conceptual proof that FucoPol has the mechanical robustness to be extruded and intentionally structured.

Table SI.1. Optimal printing parameters for a 0.5% FucoPol solution to verify POC printability.

Parameter description	Optimal value
Immersion bath contents	45% aqueous ethylene glycol (EG)
Print plate temperature	–12 ºC
Nozzle gauge	18 G
Distance from nozzle to print plate	0.7 mm
Extrusion velocity	E-3 with F200
Bioprinted layer height	2.4 mm

Figure SI.2. Photographs demonstrating the preliminary POC printability of a 0.5% FucoPol solution. The left and right panels correspond, respectively, to a printed FucoPol structure before and after complete structural freezing of the liquid fraction.