

1. Aspect Biosystems

1.1 Clogging

Identify the clogging: is it in the printhead or is it occurring at the end of the nozzle right before extruding?

- a. If it is occurring in the printhead: flush the channel/s either by using TBS or 50% of anti-adherence rinsing solution. You can do this by filling a syringe with either TBS or the rinsing solution, removing the pressure tubes (when channels are closed), inserting the syringe into the desired channel to flush, opening the channel, and then injecting the solution into the channel until the clogging passes. If you can see in which channel the clogging is occurring, you only need to flush that one – otherwise, just flush all the channels. **This may need a demo.**
- b. If it is occurring at the end of the nozzle: this is probably occurring because the nozzle-end is too close to the printing platform, so watch the nozzle-end closely and manually move the printhead up so that it's not coming in direct contact with the platform. To remove the clog, simply run the buffer solution at a high-enough pressure so that the crosslinked bioink is removed. **This may need a demo.**

None of the above suggestions work?

- c. Flush all the channels again or may need a new printhead.

1.2 Incorrect gel formation

Not the correct pressures being applied to each channel and/or the incorrect printing speed. Try the pressures and printing speeds below and if none of this works, you may need to adjust each channel until you get the correct flow.

- a. Crosslinker: 60mbar, bioink: 50mbar, buffer: 100mbar, print speed: 25mm/s.
- b. If the components being extruded are too watery: increase the crosslinker pressure or check for clogging in the crosslinker or bioink channel (see section 1.1)
- c. If the components being extruded is causing the channel to clog: Reduce the crosslinker pressure and/or increase the bioink pressure and refer to section 1.1.

1.3 Low system pressure

A leak in the system due to poor insertion of the pressure tubes

- a) Ensure that all the pressure tubes are inserted correctly to both the printer and the material reservoir (may be pushed in too far into the printhead, preventing flow or too far out).

Loose material reservoir cap:

- b) Tighten all the caps and tighten the location where the tubes go into the tube (may need a demo).

1.4 General

This table is from Emily's paper (DOI: 10.1021/acsbmaterials.8b01235) – May need to change this table around or make it into another format?

the material is not traveling up the tubes during the priming sequence	the tube is inserted too far into the inlet	pull the tube out slightly
	there is too low a pressure	ensure the proper insertion of the pressure tube and/or raise the pressure
	the brown cap fitting is screwed in too tight	loosen the fitting, it should be finger tight
no material is being printed	the print head is clogged at the bioink inlet	if gelled bioink is blocking the channel, flush the print head
		if multiple cell aggregates are collecting at the inlet, ensure the aggregates are evenly dispersed in the bioink
		use another chip or material channel if the blockage cannot be removed
	the print head is clogged at bioink/cross-linker intersection	the cross-linker pressure is too low, raise the pressure, flush the print head to remove the clog before resuming
	low system pressure	see above
the structure is being dragged along the print bed	the print head is too low	raise the print head so it does not make contact with the printed structure but not so high that the cross-linker falls in droplets
	there is a buildup at print head outlet	stop the print, remove the buildup with an ethanol-soaked Kimwipe, restart the print, and watch the print head height
the vacuum is not aspirating	there is a block in the vacuum chuck	if possible stop printing, clean the vacuum chuck, and sterilize the vacuum chuck before future use
	there is a block at the tube outlet in the waste reservoir	turn off the vacuum, remove the reservoir from the BSC and move to a vacant fume hood, open the reservoir, remove the blockage with an ethanol-soaked Kimwipe, close the reservoir, and return to the BSC after sterilizing
	there is a block inside the tube external to the printer	remove the tubing and flush completely
	there is a block inside the tube internal to the printer	bypass the internal tubing and inform Aspect Biosystems for cleaning

2. CELLINK

Still working on this - will get Kali's help.