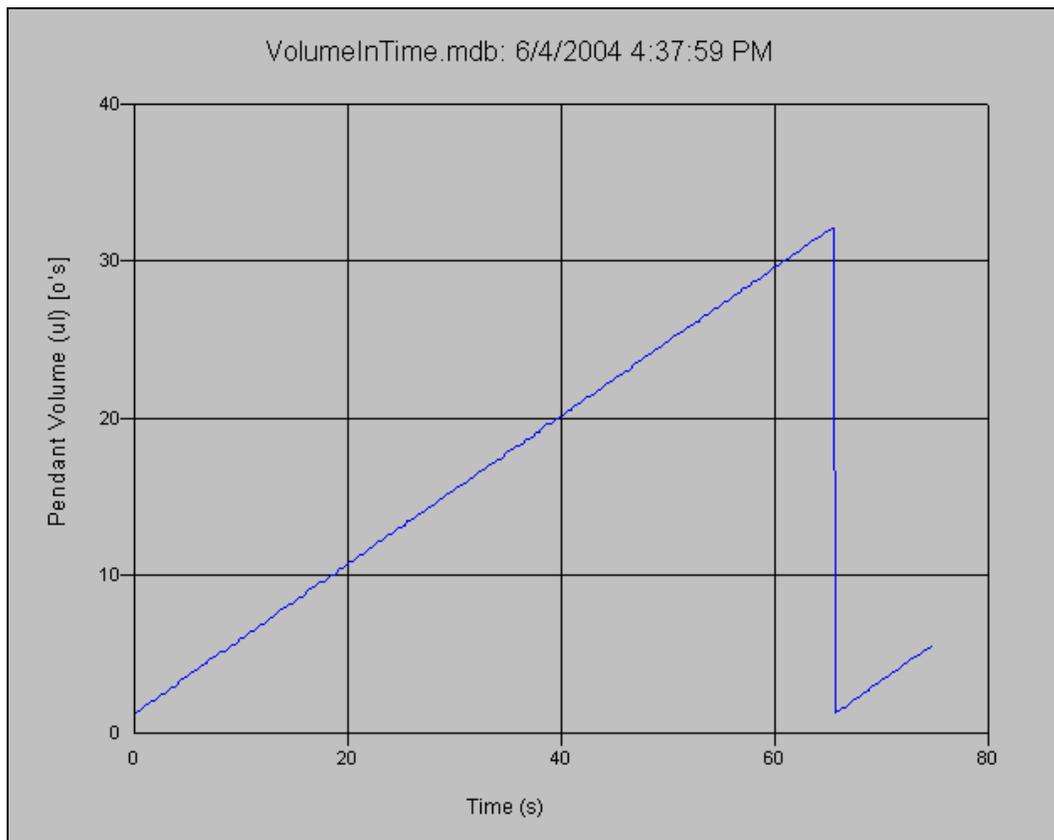


Peristaltic Pumps

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Peristaltic pumps function by squeezing flexible tubing shut with rollers that move along the tube in the direction of desired flow. They literally push the liquid inside along in front of them. The rollers are arranged on the periphery of a rotating wheel with the tube trapped against a circular plate next to the wheel.

The principal disadvantage is that there is a pause in the flow as one roller lifts off the tube and another begins pushing on the tube. The practical effect of the pause (often called a “pulse” for when the liquid does flow) can be minimized by using very small diameter tubing. Each roller push then moves only a small volume of liquid. The following graph shows the smooth flow from the smallest FTA microbore tubing which has an 0.19mm internal diameter. The graph was made on an FTA200 by requesting a flow of 0.5 μ l/s and measuring the actual pendant drop volume on the needle with the video system. One drop fell off and another began at about 65s.



The small bore tubing, generally called *microbore* tubing, is too small for barbed fittings and would not withstand the rollers well, so it is overlaid with larger tubing in the region where the pump rollers run and at the end where it attaches to the dispense needle. FTA has these sets available and instructions for making your own are included with pumps.

Several sizes of microbore tubing are available. The following table lists these and the pumping rates available with each. The 600mm length referred to is the length of tubing between the pump and the dispense needle.

	0.19mm ID	0.25mm ID	0.51mm ID	0.89mm ID
$\mu\text{l}/\text{mm}$ of length	0.02835	0.04909	0.2043	0.6221
μl in 600mm	17.0	29.5	123	373
Max speed	1.5 $\mu\text{l}/\text{s}$	2.5 $\mu\text{l}/\text{s}$	10 $\mu\text{l}/\text{s}$	10 $\mu\text{l}/\text{s}$ (limited by motor torque, not motor max speed)
Time to prime 600mm	12s	12s	12s	37s
Formulations	Tygon only	Tygon only	Tygon only	Tygon, silicone, and Viton

For the smoothest flow, choose the smallest diameter, or 0.19mm. The best all-round compromise is probably the 0.25mm ID. The 0.89mm ID tube is limited by the torque required to compress it, not by the maximum motor speed.

The pump has an adjustment of the force of the roller on the tube. This adjustment is made with a socket head screw pushing against a spring. You want to use the minimum force that will result in reliable flow. Larger tubing requires more force. If you start with an empty tube set, you can see the meniscus of the liquid rising from the supply vial. Increase the force until the liquid starts to rise, then give it one more turn for good measure.

The smallest diameter tubing has the shortest life before it gets too deformed to continue pumping. The 0.19mm ID tubing will pump at least 20ml (20cc). Using the minimum roller force will increase its life further. If your tubing seems to wear out too soon, you are using too much roller force. For longest life, unlatch the roller plate when the pump is off, so the tubing does not get a "set" in it where the roller is currently.