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Blood vessel-on-a-chip examines biomechanics of microvasculature.†

Paul F. Salipante,*[a] Steven D. Hudson,[a] and Stella Alimperti[b]

1 Supplemental

1.1 Step change

The pressure is controlled in a square wave in order to investigate if any viscoelastic response is observable on short timescales. Figure 1 shows a timeseries of the recorded applied pressure compared to measured vessel width. The response time of the pressure regulator to reach the set point is about 0.5 s. There is no observed lag in the vessel response in either increasing or decreasing pressure.

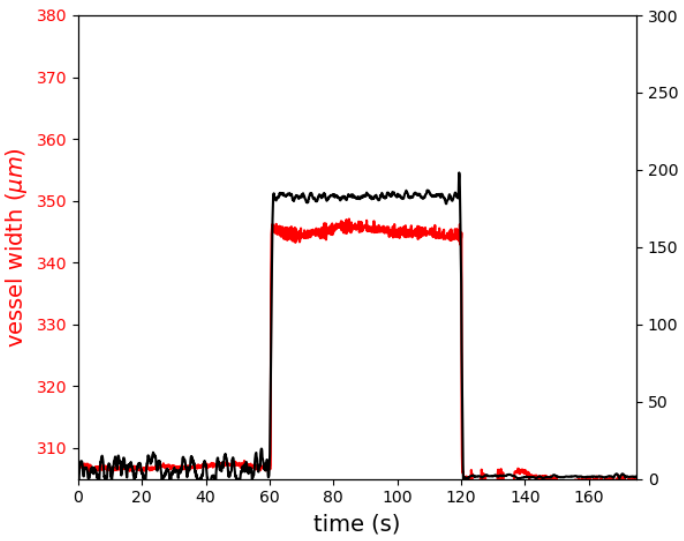

Fig. 1 Timeseries showing response of the vessel width (red) to a square wave applied pressure (black).

1.2 Local fluorescence and strain measurements

We include additional measurements of fluorescent particles expelled through the cell layer compared to the local strain measured by tracking the cell nuclei. The results shown here are similar to the results shown in section **??**. The regions of higher fluorescent signal come from regions near $s \approx 0$ and $s \approx 0.5$, closer to the side of the vessel. This vessel shows more axial variation in the fluorescent intensity and a wider region of intensity. A wider region of higher strain corresponds to to this greater fluorescence intensity.

1.3 Cell Layer Thickness

Confocal images of the vessel with membrane staining are used to measure the membrane thickness. Image slices are taken near the midpoint of the vessel and the intensity as a function of y-position is sampled at different axial locations. An example of the fluorescence intensity as a function of y-position is shown in Figure 3. The full width at half max is found by determining the distance between the roots of a spline fit to the intensity profile. An example of the measured width is shown as the shaded region Figure 3.

A mean value of 5.3 μm with a standard deviation of 1.8 μm is found from 22 measurements in different locations using 4 different devices.

[a] *Polymers and Complex Fluids Group, National Institute of Standards and Technology,100 Bureau Drive, Gaithersburg, MD, USA. Fax: 1-301-975-4924; Tel: 1-301-975-2820; E-mail: paul.salipante@nist.gov*

[b] *ADA Science and Research Institute, 100 Bureau Dr., Gaithersburg, MD, 20899*

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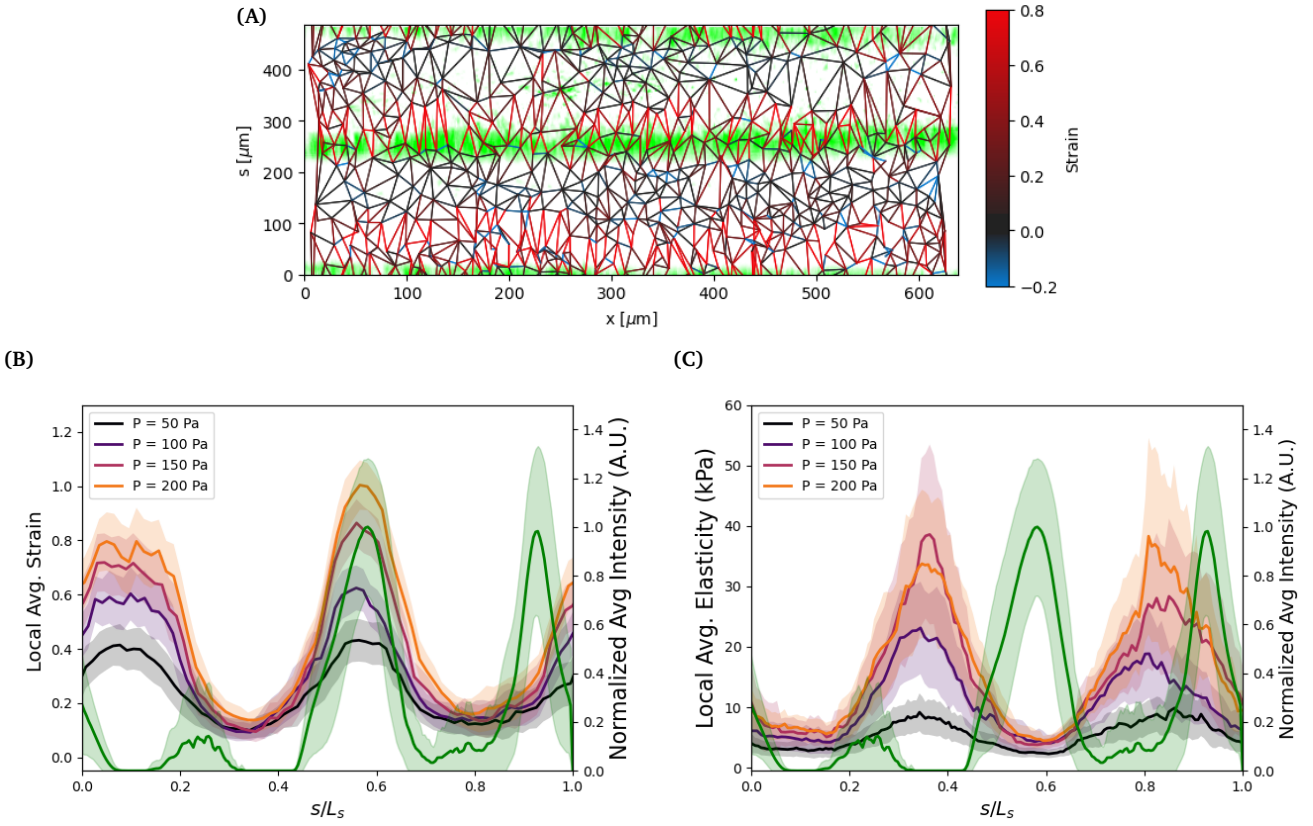

Fig. 2 Supplementary example of local strain, elasticity, and fluorescence intensity of tracer particles. A) Local Strain strain compared to fluorescence from 0.75 micrometer particles. B,C) Axial mean of particle fluorescence intensity normalized by maximum mean. The width of lines shows the standard deviation of the fluorescence intensity, strain, and elasticity along the axial direction.

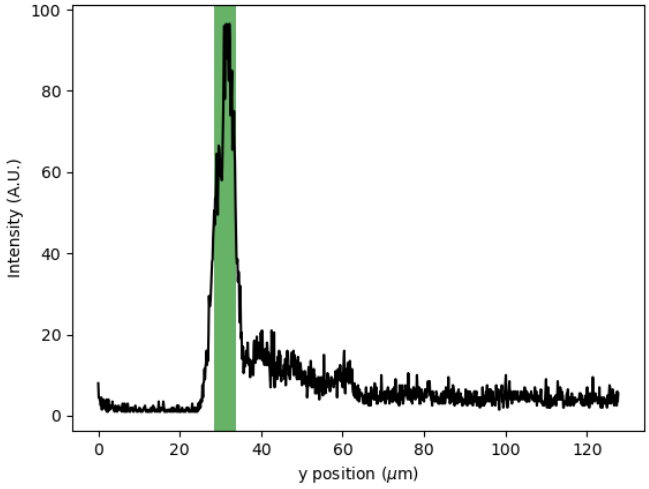

Fig. 3 Example of fluorescence intensity as a function of position along a line of pixels from a confocal image. The intensity peak shows the sidewall of the vessel. The full width at half max of 5.2 μm is shown in green.