

Exercises for Boulder Summer School 2024
Yanlan Mao, Week 4 (22, 23 July 2024)

Lymph nodes (LN) in mammals are critical for immune responses. They are formed of a network of fibroblastic reticular cells (FRC, green cells, Figure 1 below). What are the mechanical properties of this network of FRCs?

You have been provided with 2 sets of laser ablation data where FRCs in the lymph node (LN) have been ablated with a 2 photon laser (as in Fig.2, see example movies). The displacements of the ends of the cell bodies after ablation have been measured and tabulated for you in the excel file. One set has 13 cuts from control LNs. One set has 16 cuts after the LNs have been treated with collagenase, which you can assume removes the ECM/collagen fibers that the FRCs normally wrap around (Fig. 3).

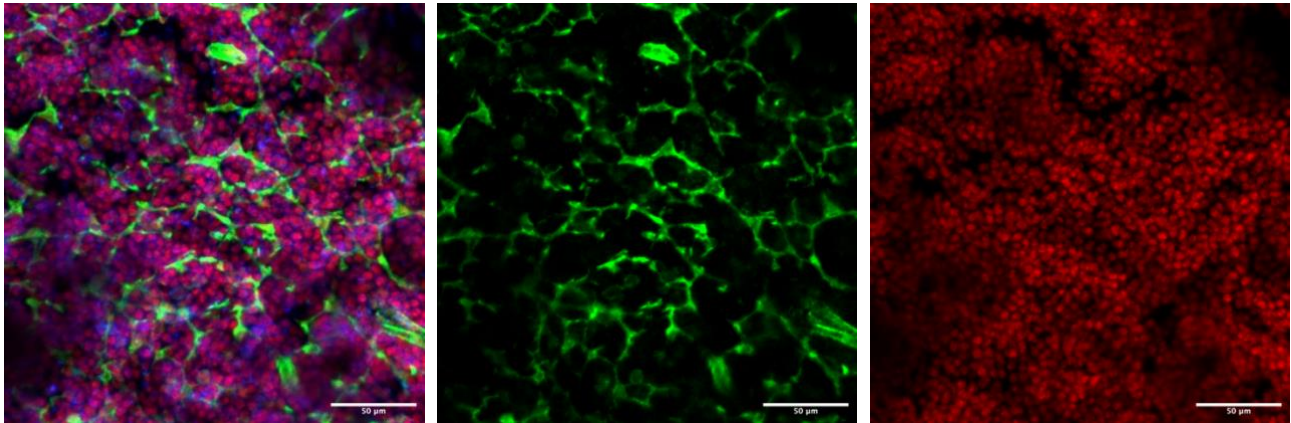
Questions:

1. Analyze the laser ablation data provided to infer the mechanical properties of the lymph node FRC network, with and without ECM (after collagenase treatment).
Infer: initial tensile force, elasticity, viscosity. Hint: model with a Kelvin-Voigt model.
2. Laser ablation alone gives you relative changes in tensile force – how would you measure absolute changes in force?

(more open ended)

3. What does the ECM do to the mechanical properties of the FRC network?
4. How would you model the lymph node FRC network if you were to develop a quantitative model?

Figure 1.



FRC, T cells

Figure 2

FRC network cartoon

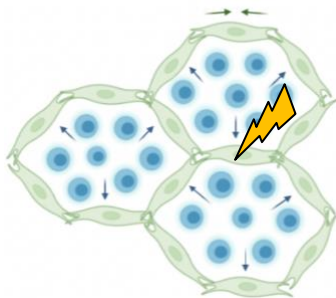


Figure 3

