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# HETEROGENEITY OF CHEMOMECHANICAL SIGNALS IN COLLAGENOUS TISSUES

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While soft biological tissues are usually considered incompressible, at least when not subjected to forced compressive conditions such as confined compression tests, recent investigations have demonstrated that moderate tensile plane stress loading causes substantial volume reduction of different collagenous membranes, permitted through efflux of interstitial fluid [1]. *In-situ* tests in a two-photon microscope and computational models of discrete fibre networks revealed that this behaviour was caused by the spatial disposition and non-linear properties of collagen fibres. Due to negatively charged proteoglycans trapped within the network, the dehydration with tension affects the chemical potential of the interstitial fluid. This chemomechanical coupling was verified in experiments, and among other implications for biomechanics, it was hypothesized that the change of osmolarity with applied tissue tension provides a mechanotransductive signal for cells [1].

In this contribution we study the heterogeneity of this signal, and how it is affected by the non-affine motion of the collagen fibres, and by the distribution of fixed charges within the network. To this end, a discrete fibre network model [1, 2] is combined with a continuous, bi-phasic and chemoelastic description [3] of the interstitial matrix, and both the homogenised and local behaviour of the materials system is analysed. The computational studies allow quantifying differences in spatial variation between osmotic signals and the mechanical signals that would be mediated through focal adhesions connected to fibres.

## REFERENCES

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