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Effect of cross-linking on the size-distribution of collagen fibrils (G)*

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We have shown that collagen fibrils have a preferred equilibrium fibril radius. However, the radial distribution of fibrils in tissues is typically polydisperse. Tendon fibrils in particular can exhibit a bimodal distribution of radii within the same tissue. This suggests non-equilibrium effects are important in fibril formation. To investigate these effects, we applied 2d coarsening dynamics to a system of fibril cross sections. We adapted the dynamics to account for both the equilibrium fibril radius and age-dependent cross-linking of individual fibrils. We find for tendon fibrils that a broad range of fibril radii are stable with respect to a bulk non-fibril (cholesteric) phase, and that cross-linking freezes the fibril distribution away from the equilibrium.

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