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Coupled actin-lamin biopolymer networks and protecting DNA

TAO ZHANG, Chemical Engineering Department, University of Pittsburgh, D. ZEB ROCKLIN, XIAOMING MAO, University of Michigan, Department of Physics, J. M. SCHWARZ, Department of Physics, Syracuse University — The mechanical properties of cells are largely determined by networks of semiflexible biopolymers forming the cytoskeleton. Similarly, the mechanical properties of cell *nuclei* are also largely determined by networks of semiflexible biopolymers forming the *nuclear* cytoskeleton. In particular, a network of filamentous lamin sits just inside the inner nuclear membrane to presumably protect the heart of the cell nucleus—the DNA. It has been demonstrated over the past decade that the actin cytoskeletal biopolymer network and the lamin biopolymer network are coupled via a sequence of proteins bridging the outer and inner nuclear membranes, known as the LINC complex. We, therefore, probe the consequences of such a coupling in a model biopolymer network system via numerical simulations to understand the resulting deformations in the lamin network in response to perturbations in the actin cytoskeletal network. We find, for example, that the force transmission across the coupled system can depend sensitively on the concentration of LINC complexes. Such study could have implications for mechanical mechanisms of the regulation of transcription since DNA couples to lamin via lamin-binding domains so that deformations in the lamin network may result in deformations in the DNA.

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