Abstract Submitted
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Nuclear Physics in a biological context DENNIS DISCHER, Univ. Pennsylvania — A solid tissue can be soft like fat or brain, stiff like striated muscle and heart, or rigid like bone – and of course every cell has a nucleus that contributes in some way small or large to tissue mechanics. Indeed, nuclei generally exhibit rheology and plasticity that reflects both the chromatin and the nuclear envelope proteins called lamins, all of which change in differentiation. Profiling of tissue nuclei shows that the nuclear intermediate filament protein Lamin-A/C varies over 30-fold between adult tissues and scales strongly with micro-elasticity of tissue, while other nuclear envelope components such as Lamin-B exhibit small variations. Lamin-A/C has been implicated in aging syndromes that affect muscle and fat but not brain, and we find nuclei in brain-derived cells are indeed dominated by Lamin-B and are much softer than nuclei derived from muscle cells with predominantly Lamin-A/C. In vitro, matrix elasticity can affect expression of nuclear envelope components in adult stem cells, and major changes in Lamin-A/C are indeed shown to direct lineage with lower levels favoring soft tissue and higher levels promoting rigid tissue lineage. Further molecular studies provide evidence that the nucleus transduces physical stress. References: (1) J.D. Pajerowski, K.N. Dahl, F.L. Zhong, P.J. Sammak, and D.E. Discher. Physical plasticity of the nucleus in stem cell differentiation. PNAS 104: 15619-15624 (2007). (2) A. Buxboim, I. Ivanova, and D.E. Discher. Matrix Elasticity, Cytoskeletal Forces, and Physics of the Nucleus: how deeply do cells 'feel' outside and in? Journal of Cell Science 123: 297-308 (2010).

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