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Heterotypic Self-Assembly of Type-I and Type-III Collagens
ESMA ERYILMAZ, Department of Physics and Astronomy, Texas A&M University, WINFRIED TEIZER, Departments of Physics and Astronomy and Materials Science and Engineering, Texas A&M University; WPI-AIMR, Tohoku University, Japan, WONMUK HWANG, Dept of Materials Science and Engr. and Biomedical Engr., Texas A&M University; School of Computational Sciences, Korea Institute for Advanced Study — Collagen fibrils, the main constituents of the extracellular matrix, are "biological alloys" that contain many additive molecules for fine-tuning the dynamical and biological properties. A representative example is the type-I collagen fibril, the most abundant among the 28 collagen types, which also contains type-III collagen. We perform atomic force microscopy (AFM) to elucidate the co-assembly of these two important members into heterotypic fibrils on mica surfaces. Time-lapse AFM imaging of samples at different ratios of type-I and type-III collagen molecules revealed that type-III assembles and nucleates fibrils slower than type-I. Furthermore, in the type-I/III mixture, nucleation appeared to be enhanced, resulting in formation of more fibrils compared to cases with either type-I or III only. We discuss possible mechanisms for the enhanced fibril nucleation in the co-assembly process of the two molecules that differ slightly in physical properties.

Esma Eryilmaz
Department of Physics and Astronomy,
Texas A&M University, College Station, TX

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