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Collagen-inspired design rules for the self-assembly of twisted filaments MARTIN FALK, MIT, Dept of Physics, LUCY COLWELL, Cambridge, Dept of Chemistry, MICHAEL BRENNER, Harvard, SEAS — Despite developments in the capacity to engineer specific interactions and structures in synthetic systems, it is clear that there is more to be done in understanding the design rules by which nature forms structure from complex substrates. One structure whose formation has yet to be understood is the collagen triple helix. Though the sequence and structure of collagen is known, an identification of the most important features for producing collagen as nature does has remained elusive. Elucidating the design rules for collagen has appeal from a synthetic self-assembly perspective as well; previous studies of specific interactions have primarily confined their attention to colloids. Through simulation, we propose a successful scheme for the self-assembly of three-twists mediated by specific interactions. We find that the twist chirality decays with a correlation length, the result of defects involving the switching of two filaments. We explore the addition of a chiral term to our scheme, and find that we form twists of one handedness. Thus we identify design rules and obstacles for the self-assembly of twists, and strategies that natural collagen may be using to overcome those problems.

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