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Nanostructure Formation in Fusion Protein Block Copolymers Containing A Globular Protein Block BRADLEY OLSEN, GUOKUI QIN, MATTHEW GLASSMAN, CHRISTOPHER LAM, DONGSOOK CHANG, MIT, ERIC SCHIABLE, ALEXANDER HEXEMER, Lawrence Berkeley Lab — Fusion proteins provide an elegant method for the synthesis of precisely defined block copolymers, where the use of molecular biology techniques enables monodisperse synthesis, precise control over block length and arrangement, and the incorporation of complex folded chain shapes and biofunctional structures. Here, we show that a block copolymer that contains a globular protein block and a coil-like protein block can self-assemble into a nanostructured material despite the chemical similarity between the two halves of the molecule. Using model polymers composed of the red fluorescent protein mCherry and an elastin-like polypeptide (ELP), the phase behavior of a simple linear fusion is shown to resemble that of protein-polymer conjugates. Molecular biology also enables the preparation of well-controlled double tailed fusion structures, and the self-assembly of these molecules shows that the chain topology of the fusion protein has a large impact on its self-assembly. At the same molar mass and composition, the double tailed structures self-assemble at a lower concentration and exhibit a greater number of order-order transitions than their single tailed counterparts. In addition, the double tailed fusions retained a higher fraction of functional protein in the final material.

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