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Liquid Crystal Based Sensor to Detect Beta-Sheet Formation of Peptides[1] MONIROSADAT SADATI, University of Chicago, ASLIN IZMITLI APIK, NICHOLAS L. ABBOTT, University of Wisconsin, Madison, JUAN J. DE PABLO, University of Chicago and Argonne National Laboratory — Protein aggregation into amyloid fibrils is involved in the progression of Alzheimer's, typeII diabetes and Huntington's diseases. Although larger aggregates remain important for clinical determination, small oligomers are of great interest due to their potentially toxic nature. It is therefore crucial to develop methods that probe the aggregation process at early stages and in the vicinity of biological membranes. Here, we present a simple method that relies on liquid crystalline materials and a Langmuir monolayer at the aqueous-liquid crystal (LC) interface. The approach is based on the LC's specific response to β-sheet structures, which abound in amyloid fibrils. When the system is observed under polarized light, the fibrils formed by amyloidogenic peptides give rise to the formation of elongated and branched structures in the LCs. Moreover, the PolScope measurements prove that the LCs are predominantly aligned along the fibrils when exposed to a β-sheet forming peptide. In contrast, non-amyloidogenic peptides form ellipsoidal domains of irregularly tilted LCs. This method is capable of reporting aggregation at lipid-aqueous interfaces at nanomolar concentrations of the peptide, and much earlier than commonly used fluorescence-based techniques.

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