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Proteins at flowing interfaces: From understanding structure to treating disease DAVID POSADA, JAMES YOUNG, AMIR HIRSA, Rensselaer Polytechnic Institute — The field of soft matter offers vast opportunities for scientific and technological developments, with many challenges that need to be addressed by various disciplines. Fluid dynamics has a tremendous potential for greater impact, from broadening fundamental understanding to treating disease. Here we demonstrate the use of fluid dynamics in two biotechnology problems involving proteins at the air/water interface: a) 2-Dimensional protein crystallization and b) amyloid fibril formation. Protein crystallization is usually the most challenging step in X-ray diffraction analysis of protein structure. Recently it was demonstrated that flow can induce 2-D protein crystallization at conditions under which quiescent systems do not form crystals. A different form of protein structuring, namely amyloid fibrillization, is also of interest due to its association with several neurodegenerative diseases such as Alzheimer's and Parkinson's disease. Protein denaturation, which is the root of the fibrillization process, is also a significant concern in biotherapeutics production. Both problems are studied by using shearing free-surface flows in simple geometries. The common finding is that flow can significantly enhance the growth of protein structures.

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