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Dynamics of Individual Flexible Biopolymers in a Microvortex Flow CHAO-MIN CHENG, PHILIP LEDUC, Carnegie Mellon University, CARNEGIE MELLON UNIVERSITY TEAM — Research in single polymer dynamics has provided exciting insights including increasing the understanding of cellular structures. Additionally, advances in micro-scale technologies such as microfluidics have been widely used for analyzing biological responses at the cellular and molecular levels. We describe observations of the real-time dynamics of individual flexible polymers (fluorescently labeled DNA molecules) under a microvortex environment through a pressure-driven microfluidic approach. This allows us to create a microvortex flow on a single molecule, which can simultaneously be imaged to determine the structural response of the individual molecule. The DNA exhibits distinct conformations and controlled curvatures that are influenced by both extension and bending dynamics, which can be directly correlated to their location within the microvortex. We analyzed the dynamics of these individual molecules and determined the elongation strain rate and the curvature under the pressure-driven flow. Their overall orientation ranges from parallel in the main inlet channel to perpendicular while being deformed within the flow inside of the microvortex. These results provide insights that will be important in numerous areas such as single molecule dynamics and polymer physics.

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