Microtubules, the largest filaments in the cytoskeleton, play an important role in cellular division, intracellular transport, and the structural shape to the cell. Each of these functions requires that microtubules be stiff when forming the scaffolding for the cell and flexible when the cell needs to divide. The mechanics of microtubules has been an active branch of research for both physicists and engineers alike for more than 30 years. However, a consensus has not been reached regarding their measured persistence length. Here we present our experimental results on microtubule mechanics and how persistence lengths may be altered by: purification, labeling, age, salt content, or the presence of microtubule-associated proteins (MAPs) which are typically found in cells.

To address these questions, we use the freely fluctuating filament assay, along with the statistics of bootstrapping, to find that combinations of these stabilizers have novel effects on the mechanical properties of microtubules.