**Microtubule shrinkage: Powerful elastic bending or stochastic thermal unzippering?**

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Microtubules are intriguing nano-machines inside biological cells. They have a cylindrical shape and are made of 13 elastic filaments (protofilaments), that can be either in a straight or a curved conformation depending on the chemical state of the constituent tubulin molecules. Interplay between these two conformations help microtubules to display a fascinating phenomenon known as “dynamic instability” where the microtubule cylinder steadily self-assembles and catastrophically disassembles in a seemingly random process. Scientists have been trying to understand how the laws of mechanics and statistical thermodynamics determine this stochastic behavior. I will present our recent investigations on how the chemical bonding between protofilaments, bending elasticity of protofilaments and thermal forces determine the speed of disassembly of the microtubule cylinder. In the current literature, it has been presumed that elastic energy of the curved conformation of protofilaments is what drives the disassembly. We show that this notion is incorrect as this would lead to a paradox when compared with the available experimental data. Resolving the paradox, we argue that the disassembly is a result of an intricate molecular orchestration where the thermal and curvature energies of protofilaments competed with inter-protofilament bonding energy in the presence of de-polymerisation of protofilalements. Taking all these factors into account we present a unified and consistent picture that can explain all the experimentally observed features of microtubule shrinkage.