PROJECT TITLE: Exploring the role of molecular machines in breaking apart cytoskeletal filaments

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Project Description

Research in the Dima group focuses on understanding the role of various structural and cellular factors in the mechanical response of biological molecules ranging from small multi-domain proteins to large fibrillar assemblies that play crucial roles in fundamental processes such as the maintenance of the cell shape, cell mobility, cell-cell adhesion, wound closure, axonal growth, and cellular division (mitosis). A project for a WISE student is "Exploring the role of molecular machines in breaking apart cytoskeletal filaments". Microtubules, the main component of the cell cytoskeleton, play fundamental roles in cellular processes ranging from cellular transport to mitosis. These roles are all intimately connected with microtubules' ability to depolymerize under controlled cellular conditions. This control is exerted by a large array of molecular machines (300 or so species). Recent experimental results strongly suggest that this large array of protein cofactors work by applying mechanical forces to the microtubule lattice, but little is known about the details of the process, their binding sites, and chemical kinetics. The goal of this project is to study the changes in the mechanical behavior of microtubules in the presence of motors which induce microtubule depolymerization upon the start of mitosis. The student will gain experience with bioinformatics methods and protein databases, learn to use simulation software to follow protein structure deformation under applied forces, and gain knowledge of current scientific literature on the subject.