08 Accelerator Grants

Mechanoradicals as a novel form of mechanosensing: from protein stretching to animal aging

Accelerator Grant

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- Alexander Dunn, Dept. of Chemical Engineering, Stanford University, USA
- Frauke Gräter, Dept. of Biomolecular Mechanics, MPI for Polymer Research, Mainz, Germany
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In this project, we are exploring how mechanical stress affects tendons at a microscopic level. By applying various forces to slices on a glass surface, we aim to measure the stiffness of the surrounding extracellular matrix (ECM) and observe how these forces trigger the production of reactive oxygen species (ROS), like hydrogen peroxide (H_2O_2). Since the ECM has different properties depending on the direction of force, we need to measure its stiffness in both horizontal and vertical directions.

Through the integration of Jie Yan as an Accelerator Member, we will be able to develop a new tool using a highly flexible micropipette with a tiny bead that can apply both horizontal and vertical forces to the tendons. We will observe how the tendons locally deform under these forces using high-resolution imaging. To detect the ROS produced, we will use special chemical reactions that light up in the presence of H_2O_2. Additionally, we will apply torsional stress with rotating magnetic beads to study the ROS generation more efficiently.

We are also investigating how ROS, particularly H_2O_2, might damage several important proteins in the ECM and within cells that respond to mechanical stress. These proteins often change shape under stress, making them vulnerable to ROS. Our research will focus on how these proteins can be affected by H_2O_2, looking at issues like protein misfolding and aggregation.