Feeling the force: molecular mechano-sensors in biological systems

Abstract:

Biological systems sense and respond to mechanical forces. The hallmark of a mechano-sensing molecule is a functional switch when subjected to a mechanical force. I will present results on how we have identified, using Molecular Dynamics simulations in conjunction with single molecule force spectroscopy, protein molecules as new candidates for such mechanical switches. We more recently also discovered a very different way of 'feeling the force' which we propose to be at play in collagen, the major force-carrying protein material of our body: Protein covalent bonds rupture under high forces, resulting in radicals and oxidative stress molecules. I will present simulations and electron-paramagnetic resonance spectroscopy experiments that show how collagen has been designed by evolution not only to carry but also to sense high mechanical loads through mechanically generated radicals.