# Molecular Force Sensors: from molecular mechanisms towards applications in biology and materials science

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Biological systems are highly sophisticated smart materials. They are stimuli-responsive and possess impressive self-reporting and self-healing properties. They are consequently an important source of inspiration for materials scientists who aim to implement these properties in synthetic and biomimetic materials. This talk will introduce the concept of molecular force sensors. In biological systems, these sensors detect a mechanical stimulus and convert it into a biochemical signal. Mimicking their natural counterparts, a number of different force sensors have been designed in recent years that yield an optical readout signal (fluorescence). Following a calibration of the mechanical properties, these artificial force sensors can report on molecular forces *in situ* in a broad range of different applications.

I will summarize our efforts towards designing and characterizing molecular force sensors, focusing on two classes of force sensors that are based on fundamentally different molecular mechanisms: The first class utilizes biological molecules that form thermodynamically stable, non-covalent interactions, such as short, double-stranded DNA duplexes or antibody-antigen interactions. These force sensors report on forces in the range between 10-200 piconewton, making them ideal candidates for applications in biological systems. The second class is based on a latent organic catalyst that becomes activated at forces above several hundred piconewton. Once activated, the catalyst produces fluorescent molecules, directly indicating that the threshold force has been reached. When introduced into a material, the liberated catalyst can potentially catalyze a reaction that leads to material repair.