

IMPRS on Multiscale Biosystems

Project description

Title: Molecular Force Sensors for the Extracellular Matrix

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Project description: Besides biochemical signaling, cells also utilize mechanical information to communicate with their environment. They constantly pull on the extracellular matrix (ECM) thereby testing its mechanical properties. Among many other processes, the ECM properties determine stem cell differentiation and cancer development. Little is currently known about the magnitude of the molecular forces determining these cell-ECM interactions. In this project you will develop synthetic molecular force sensors that will allow the measurement of these forces. The force sensors will be inserted into synthetic ECM mimics with controlled mechanical properties. In this way you will be able to systematically correlate molecular forces with the ECM properties as well as cellular function. This information will provide clues for the rational design of synthetic ECM mimics for specific applications.

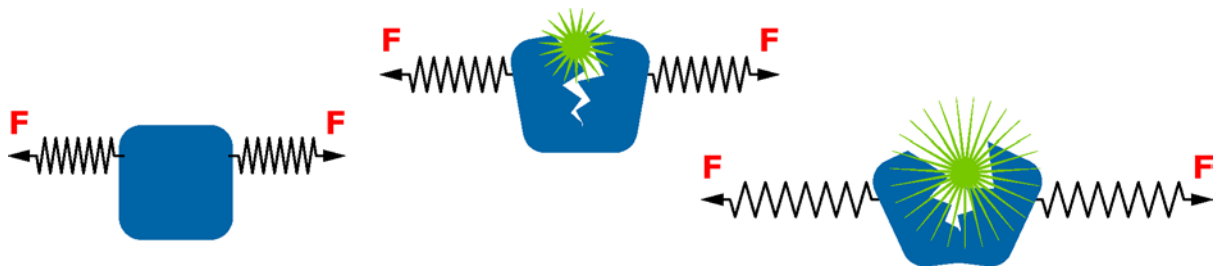


Figure 1. Design principle of a molecular force sensor. The sensor is equipped with a fluorescence readout that changes its optical properties as a function of the applied force.

To achieve these goals, you will synthesize and characterize molecular force sensors spanning a range of different forces. For the characterization of their mechanical properties you will use atomic force microscopy. You will further develop methods to integrate these molecular force sensors with the synthetic ECM. More specifically, you will use bioconjugation methods to prepare peptide-polymer conjugates. The characterization of the mechanical and biochemical properties of this hybrid material will involve rheology as well as fluorescence microscopy. Finally, you will grow cells in this new material to investigate the forces involved in cell-material interactions.

Required background: You have a MSc degree in Chemistry, Physics, Nanotechnology, Materials Science or similar with a strong interest in biophysical chemistry or biophysics. Experience in more than one of these areas is highly appreciated.

Paper to read before the interview: not required

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