HIGH-SPEED ATOMIC FORCE MICROSCOPY SIMULTANEOUS TO ADVANCED OPTICAL MICROSCOPY

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Abstract

Last few decades have established the atomic force microscope (AFM) as an indispensable tool for high-resolution studies under native conditions. Recent tip-scanning AFM developments now offer an insight into the dynamics of macromolecular systems, while simultaneously offering a seamless integration with advanced optical microscopy.

In this study, we non-invasively monitor and modify the kinetics of collagen type I fibrillogenses. Collagen type I has received a lot of attention over the last five decades, due to their large interactome, hierarchical structural and mechanical stability. We show that fast AFM imaging can be successfully applied to understand the real-time kinetics of collagen type I formation. By further modifying the used buffer compositions, pH value and potassium ion content, we demonstrate that we can accelerate the kinetics of the fibrillar nanomatrix formation and successfully study it with high spatial and temporal resolution.

Additionally we show the capability of combining AFM with super-resolution techniques to demonstrate the relation of cytoskeleton distribution and mechanical properties of HeLa cells. Alexa647 labeled microtubules are imaged with dSTORM, while the cell surface and mechanical information are measured in parallel by AFM.

Keywords: AFM, superresolution microscopy, STORM, microbiology

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