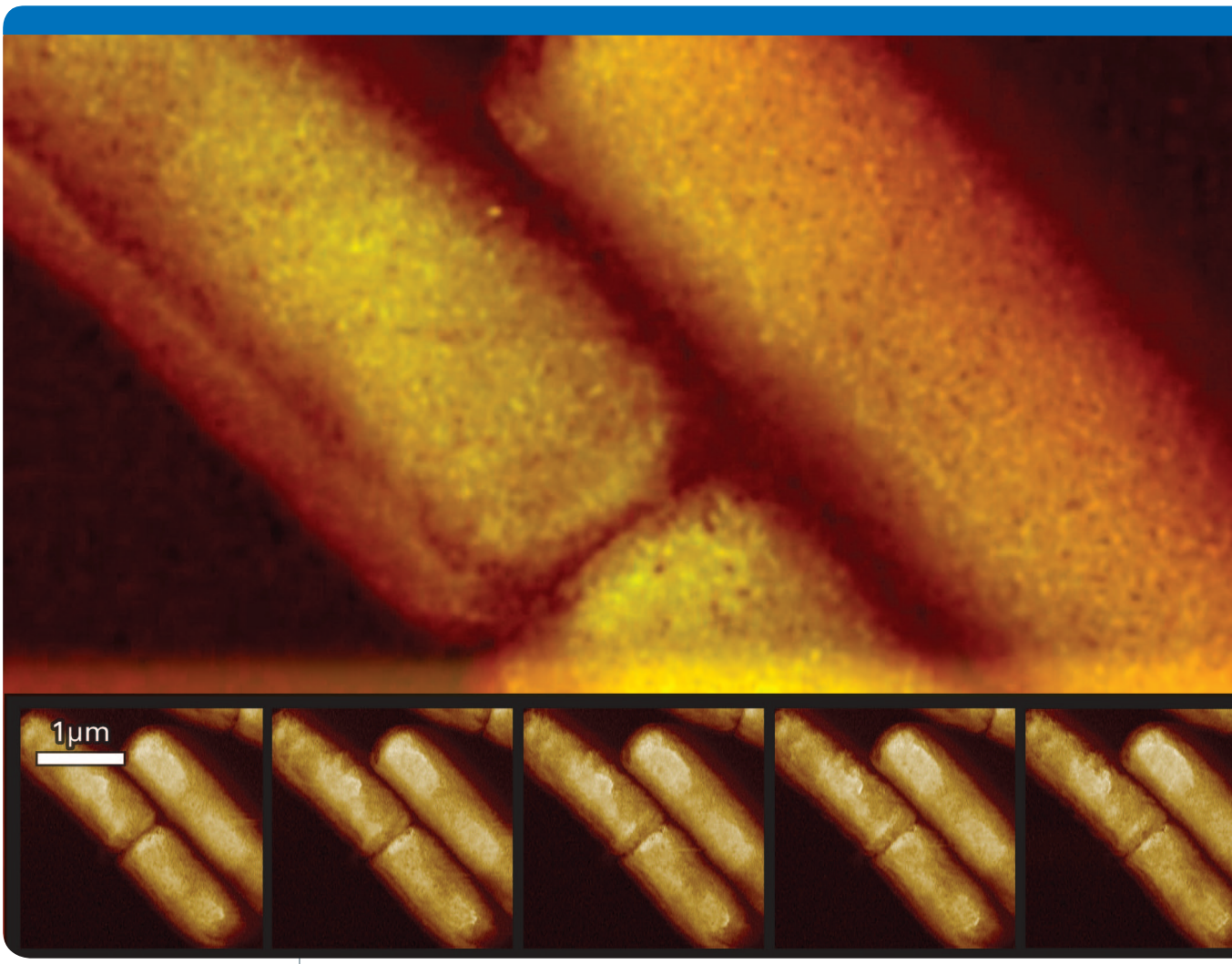


Dimension FastScan Bio AFM

Capturing Biological Dynamics with Ease

Atomic Force Microscopy

Innovation with Integrity

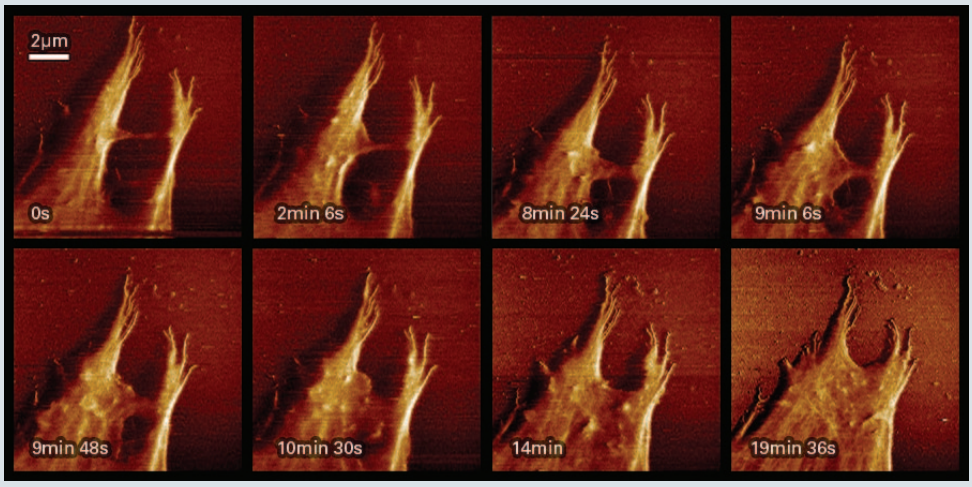
Dimension FastScan Bio — The New Standard

The Dimension FastScan Bio™ Atomic Force Microscope (AFM) enables high-resolution research of biological dynamics, with temporal resolution of up to 3 frames-per-second for live sample observations. What's more, it does this while making the AFM easier to use than ever before.

Atomic force microscopy has been gaining an incredible amount of interest among today's leading life science researchers and educators, both due to its nanoscale imaging capabilities and the physical interaction between the probe and sample. FastScan Bio is built upon the world's most advanced large-sample AFM platform, the Dimension FastScan™.

FastScan Bio AFM adds specialized life science features to this platform, and has been specifically designed for high-resolution, live-sample observation of interacting molecules, membrane proteins, DNA protein binding, inter-cellular signaling and many other dynamic biological studies. Bruker's new innovative probe design with unique cantilever shape and coating enables an uprecedented combination of imaging speed and softness. The resulting system delivers the scanning speed required for high-resolution spatiotemporal studies with the greatest simplicity ever seen in a commercial AFM system:

- Simplified sample engaging and controls for immediate imaging
- Real-time panning, zooming and scanning
- Feature tracking and Movie creation tool
- Micro-volume fluid cell with controlled fluid exchange



AFM image sequence of the leading front of a migrating stem cell showing the formation of two extended lamellipodia. As the cell 'crawls' forward, membrane flows to the cell front filling in the space between the lamellipodia. Images were recorded every 40 seconds at a resolution of 512 x 128 pixels.

High-Resolution Investigation of Biological Dynamics

Greatest Productivity Seen on Any AFM

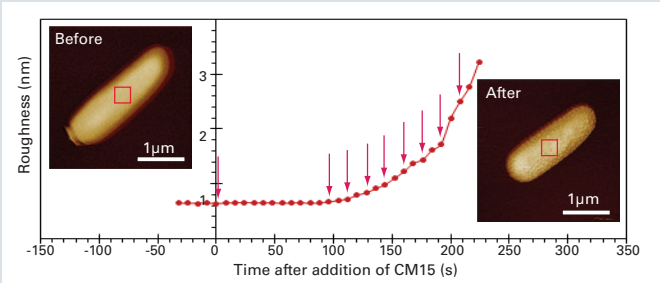
- FastScan Bio enables high-speed scanning, in conjunction with a seamless user interface for panning, zooming and continuous tracking of samples in fluid to render faster results
- A single-scan speed slider facilitates immediate access to scan rate control without the complexity of multi-parametric adjustment
- Feature tracking allows users to identify features and track trajectory of motion and rate of change
- On-board data and image manipulation tools present final data as high-resolution AFM images or experiment-session movies

Immediate Path to Data Collection on Live Samples

- Smart Engage algorithms take ambiguity out of the experiment process and provide flexibility for commercially available or custom-made probes
- User interface controls automate laser and detector alignment with a comprehensive workflow for faster time to data
- Quick sample engaging and immediate imaging are routine

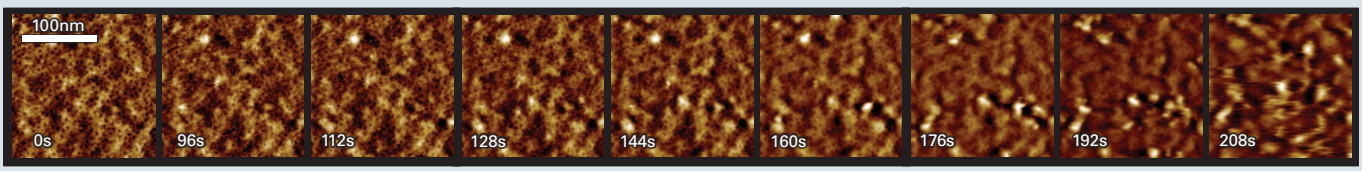
More Options to Optimize Biological AFM Experiments

- Innovative FastScan AFM technology enables high-speed scanning and a seamless user interface to render immediate panning, zooming and continuous tracking of samples in fluid
- FastScan Bio AFM allows direct visualization of biomolecules with an unprecedented combination of spatial and time resolution



Graph showing the rapid increase in surface roughness of the outer membrane of a live *E. coli* cell after exposure to the antimicrobial peptide CM15 (20µg/mL). Data points corresponding to the individual images in video strip below are indicated by the arrows. The inset phase images show the location on the cell where the high-resolution data was obtained (red boxes) and confirm that the observed changes to the outer membrane structure occurred over the entire cell and thus were not tip-induced.

Time series of CM15 antimicrobial activity on live *E. coli* cells. CM15 (10µg/mL) was added to the imaging fluid at t=0s and images recorded every 18s at a resolution of 1024 x 256 pixels. Every seventh image in the time series is shown once the effects of CM15 were first observed at ~7.5min. HS-AFM imaging revealed an increase in the roughness or corrugation of the bacterial cell surfaces that is believed to be the direct result of the incorporation of CM15 into the outer membrane. The onset of these changes was observed to occur at different times for individual cells.

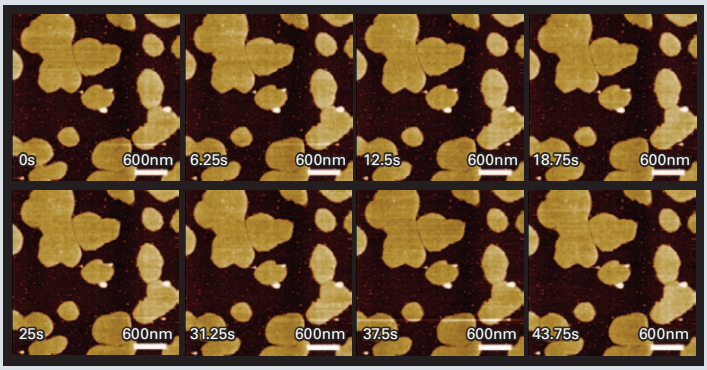


FastScan AFM imaging allowed direct observation of nanoscale ordered structures, corresponding to closely packed porin molecules, on the native outer membrane of live *E. coli* cells. CM15 (20µg/mL) was added to the imaging fluid at t=0s and images were recorded every 8 seconds at a resolution of 1024 x 256 pixels. Every second image in the time series is shown after ~96s incubation when the effects of CM15 were first observed as an increase in membrane roughness (corresponding graph shown above), accompanied by the disappearance of the ordered porin structures, membrane micellization, and the appearance of "pore-like" lesions in the membrane surface.

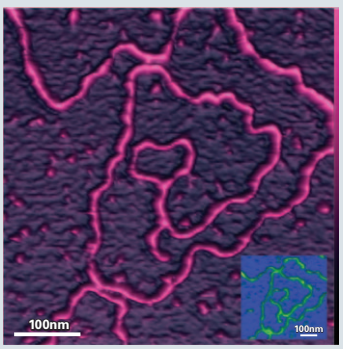
High-Resolution Biological Dynamics in Your Lab Is a Reality Today

In-situ high-resolution dynamic studies with nanoscale resolution are a reality for a rapidly evolving branch of biological research. Dimension FastScan Bio breaks long-standing barriers to provide these capabilities for routine experimentation. These breakthroughs allow many more researchers to observe and study biomolecular structures and mechanisms. FastScan Bio's high-resolution and high-speed scanning provide the best available bio tool for the observation of molecules, proteins, DNA, RNA, living cell membranes and tissues, and many other dynamics studies.

The AFM is no longer a specialists' tool. FastScan Bio AFM provides the new standard for biological dynamics, making high-resolution and high-speed AFM scanning a reality for every life sciences laboratory.



Time series of (1:1) DOPC/DPPC supported planar lipid bilayers. Consecutive images, recorded at 0.16 frames-per-second, demonstrate the stability of the taller DPPC gel phase domains and hence the highly sensitive force control of FastScan at high scan speeds. Imaging was conducted using TappingMode™ under aqueous conditions. Height images are shown. (Image size = 3µm; Z-scale = 3.2nm.)



High-resolution image of DNA recorded at 0.5 frames-per-second. Lambda digest DNA was adsorbed on a mica surface and imaged using TappingMode under aqueous conditions. The inset image shows same DNA strand captured at 3 frames-per-second. (Image size = 500nm; feature height = 1.8nm; Z-scale = 4.3nm.)

FastScan Bio AFM Specifications

Parameter	Scanner Specifications
X-Y scan range	35µm x 35µm typical, 30µm minimum
Z range	≥3µm
X-Y tip-velocity max. (1% tracking error)	>2mm/s
Z tip-velocity max.	12mm/s
Sample environment — Flow cell	60µL
Sample heating stage (optional)	RT – 120°C (Air); RT – 45°C (Fluid, specimen on glass slide)
Probes	FASTSCAN-B, FASTSCAN-C, FASTSCAN-Dx, USCEBD300KHZ (optional)

Cover image
FastScan Bio AFM tip superimposed on CM15 antimicrobial activity on live *E. coli* cells.

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