Submission Date: 04/28/2025

2024 Academic Year Bio-SPMs Collaborative Research
Research Report Summary

Title of the research project		**High-speed AFM imaging of T7 bacteriophage tail-fibers**	
PI (Person in charge of the research project)	Name	Balint Kiss	
	Affiliated Institution and Department/Division/etc.	Department of Biophysics and Radiation Biology, Semmelweis University	
	Position	Postdoc researcher	
Bio-SPMs that you used (Check the boxes)		☐	Atomic resolution/3D-AFM
		x	High-speed AFM
		☐	SICM
		☐	AFM for Cell Measurement
Collaborative NanoLSI Faculty Members		Hiroki Konno, Soma Yamamoto, Noriyuki Kodera	

Our goal was to image T7 tail fibers by using HS-AFM and understand their structural dynamics. The tail-fiber is a trimer of the gp17 protein of the T7 bacteriophage, which is primarily used in host cell recognition processes. By expressing gp17 proteins using transfected *E. coli* bacteria we have successfully obtained a homogeneous and clear sample with high enough concentration for HS-AFM imaging. Imaging was performed on APTES coated mica surface, which has allowed sufficient immobilization of the fibers. After optimizing buffer salt concentrations, a sample surface coated by loosely bound tail-fibers was achieved. Fibers were identified as immobilized “L” shaped structures, always found in an anticlockwise orientation. The fibers consist of a thinner proximal, and a thicker distal region, which enclose approximately an angle of 90°. Fiber distal to proximal region bending within ~90 to ~120° and the unwinding of the proximal region triple helix were visualized. Both of these processes may play a crucial role in allowing some flexibility in host recognition and phage to the target cell anchoring. We also propose a model, which suggests that the fibers immobilized on the phage surface are in a torsionally loaded state, and their release directly leads to an extended orientation, resulting in more efficient anchoring on the bacterium.

*This form (Form 3) will be open on the NanoLSI website in the following academic year.

*Note that this form should be prepared in one A4-size paper.

*Submission Deadline: May 9, 2025 (Friday). Submit it as a PDF file.

*Submission Destination: the person in charge of Bio-SPMs collaborative research at WPI-NanoLSI, Kanazawa University