THE HIGH-SPEED AFM AND MOTION PICTURES.

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The atomic force microscope (AFM) is a powerful tool for imaging individual biological molecules in aqueous solution. Yet, its temporal resolution is restricted by speed limitation of the AFM. We have aimed to make great progress of the scan speed of the AFM to take movies of protein actively performing its function. We have developed a high-speed scanner without resonant vibrations up to 250 kHz, small cantilevers with high resonance frequencies (450-600 kHz) and small spring constants (100-240 pN/nm), an objective-lens type of deflection detection device, and several electronic devices with wide bandwidths (1 MHz). Assembly of these devices has produced an AFM apparatus that can take an image (100x100 pixels) within 0.4 sec, and can produce a movie consisting of many successive images (0.4 sec intervals) of samples in aqueous solution.