

High-speed atomic force microscopy reveals dynamic molecular processes in photo-activated bacteriorhodopsin

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Supplementary Movie 1 | High-speed AFM movie of the cytoplasmic surface of D96N at pH 7 during dark-illumination cycles. The purple membranes containing the D96N bR mutant were adsorbed onto a mica surface in 10 mM Tris-HCl (pH 7) and 300 mM KCl. Frame rate: 1 fps; pixel size: 150×150 pixels. The green bars shown in the AFM movie indicate green-light illumination. A bR trimer is highlighted by the white triangle at the first frame. This movie is played at ×10 speed.

Supplementary Movie 2 | High-speed AFM movie of the cytoplasmic surface of WT at pH 7 during dark-illumination cycles. The purple membranes containing WT bR were adsorbed onto a mica surface in 10 mM Tris-HCl (pH 7) and 300 mM KCl. Frame rate: 1 fps; pixel size: 150×150 pixels. The green bars shown in the AFM movie indicate light illumination. A bR trimer is highlighted by the white triangle at the first frame. This movie is played at ×10 speed.

Supplementary Movie 3 | High-speed AFM movie of the cytoplasmic surface of WT at pH 10 during dark-illumination cycles. The purple membranes containing WT bR were adsorbed onto a mica surface in 10 mM Tris-HCl (pH 10) and 300 mM KCl. Frame rate: 1 fps; pixel size: 150×150 pixels. The green bar shown in the AFM movie indicates light illumination. A bR trimer is highlighted by the white triangle at the first frame. This movie is played at ×10 speed.

Supplementary Movie 4 | High-speed AFM movie of the cytoplasmic surface of D96N at pH 7 with increasing light intensity. The purple membranes containing D96N bR were adsorbed onto a mica surface in 10 mM Tris-HCl (pH 7) and 300 mM KCl. Frame rate: 1 fps; pixel size: 200×200 pixels. While imaging, the light intensity was gradually increased in eight steps. The green bars indicate the illumination periods,

and their shade level indicates the relative light intensity. A bR trimer is highlighted by the white triangle at the first frame. This movie is played at $\times 10$ speed.

Supplementary Movie 5 | High-speed AFM movie of the extracellular surface of D96N at pH 7 during dark-illumination cycles. The purple membranes containing D96N bR were adsorbed onto a mica surface in 10 mM Tris-HCl (pH 7) and 300 mM KCl. Frame rate: 1 fps; pixel size: 200 \times 200 pixels. The green bars shown in the AFM movie indicate light illumination. A bR trimer is highlighted by the white triangle at the first frame. This movie is played at $\times 10$ speed.