

## Description of Additional Supplementary Files

File Name: Supplementary Movie 1

Description: Three-dimensional reconstruction of cryo-ET data demonstrating MSHA distribution on the cell surface.

File Name: Supplementary Movie 2

Description: Video of time-lapse visualization of MSHA retraction shown in Figure 2a. Video shows overlay of digitally filtered fluorescence and bright-field microscopy images collected every 6 seconds over 10 minutes, played back at 5 frames per second (fps).

File Name: Supplementary Movie 3

Description: Video of MSHA retraction shown in Supplementary Figure 1d. Video shows overlay of digitally filtered fluorescence and bright-field microscopy images collected every 6 seconds over 10 minutes, played back at 5 frames per second (fps).

File Name: Supplementary Movie 4

Description: Video of MSHA retraction in the *mshE*<sup>L10A/L54A/L58A</sup> strain. Video shows overlay of digitally filtered fluorescence and bright-field microscopy images collected every 6 seconds over 10 minutes, played back at 10 frames per second (fps).

File Name: Supplementary Movie 5

Description: Video of time-lapse visualization of MSHA extension from Supplementary Figure 1e. Video shows overlay of digitally filtered fluorescence and bright-field microscopy images collected every 6 seconds over 6 minutes, played back at 5 frames per second (fps).