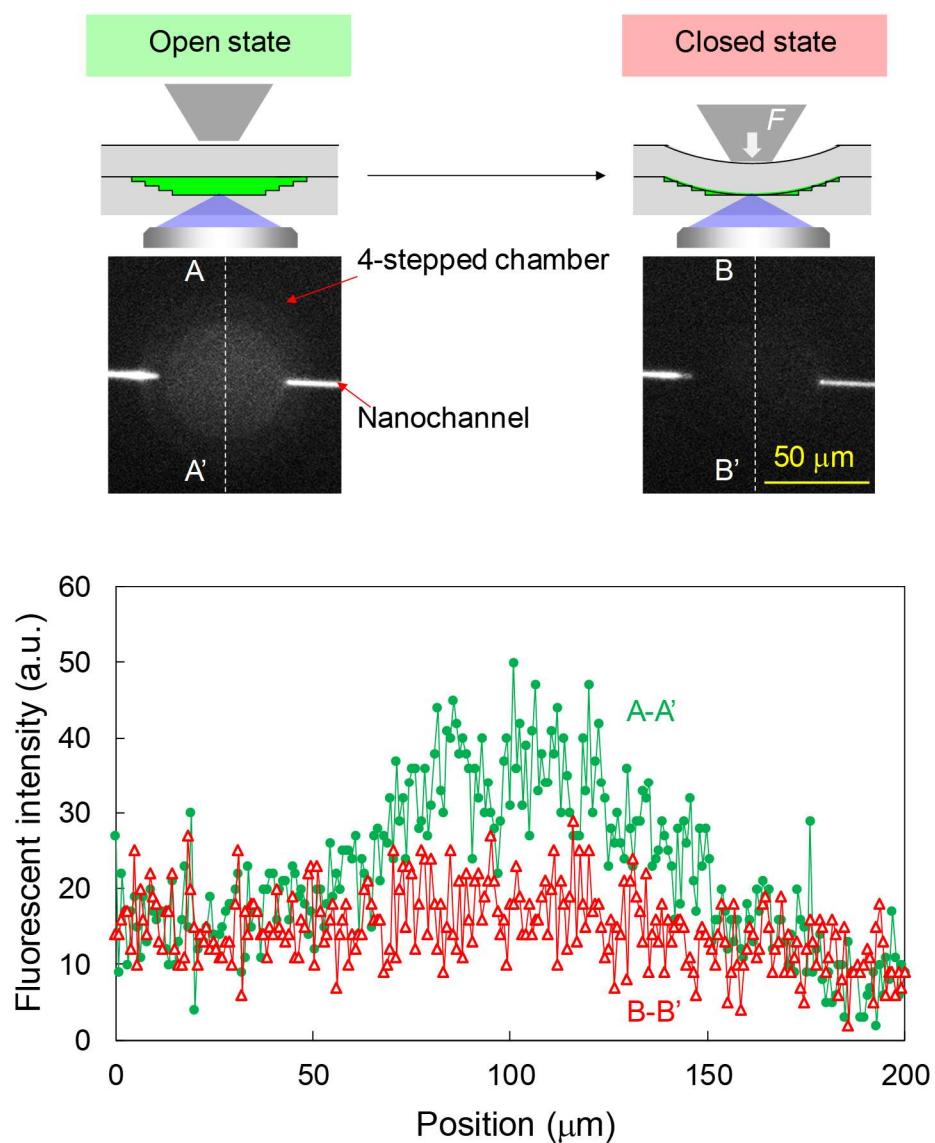
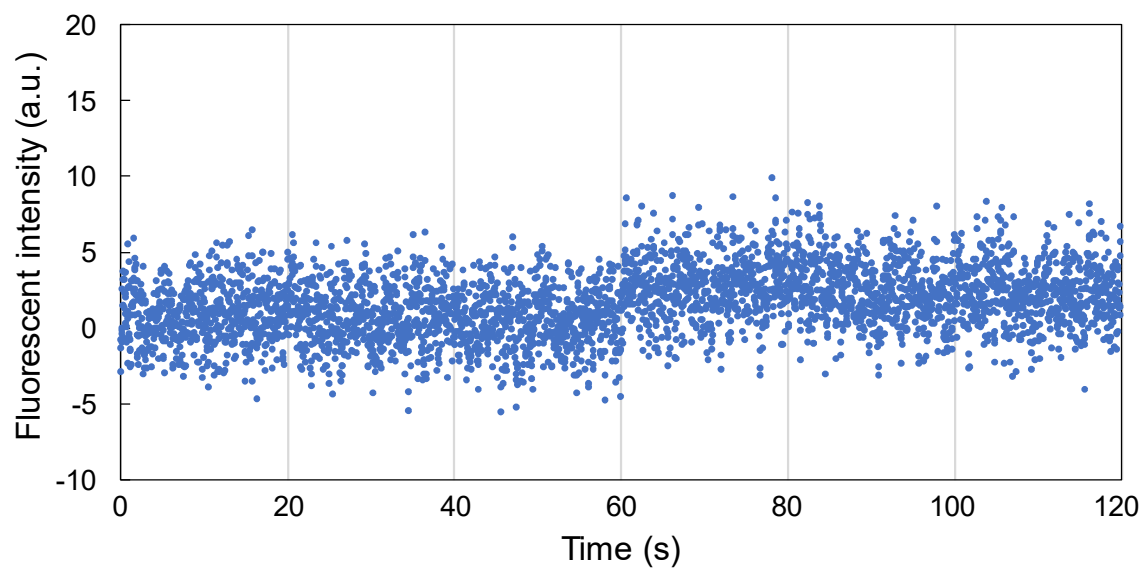


Supplementary Figures:



**Figure S1.** Profiles of the image intensity along the four-stepped valve chamber at open and closed states.



**Figure S2.** The fluorescent intensity-time profile at downstream nanochannel ( $x = 0 \mu\text{m}$ ) during the closed state. It is a magnified graph of Figure 9. Noted that the fluorescent intensity was obtained by subtracting a background intensity from the image intensity.