Formin's processivity under applied force

Formin, a key actin regulator, is involved in a number of pathologies. It is able to keep tracking the barbed end of actin filaments for a finite time, while accelerating actin polymerisation in the presence of profilin. In cells, formin's behaviour is precisely regulated by different factors, including local actin/profilin concentration, mechanical forces and other actin associated proteins. Clarifying the mechanism of formin's processive movement is essential in order to understand formin's behaviour. However, so far, how formin's processivity responds to various chemical or mechanical conditions is still unclear.

Here, we investigated how formin dissociates from the barbed end for different actin/profilin concentration and/or for various applied pulling forces, in order to answer 1) whether profilin has an impact on formin's processivity; 2) how formin's processivity responds to applied forces.

We found that formin's dissociation rate (k_{off}) from actin barbed end has a positive correlation with its elongation rate (V_{elong}) at fixed profilin concentration. However, when the concentration of profilin is increased, k_{off}/V_{elong} is decreased. These results indicate that formin's processive movement is improved by the presence of profilin.

Also, we found that formin's processivity is very sensitive to applied pulling forces. Formin's dissociation rate increases exponentially with force, even at relatively small force (<10 pN) is applied. Moreover, we found that force has a dominant impact on formin's processivity, for all actin/profilin concentration that we tested, irrespective of the elongation rate.

Finally, our study of formin's processivity will contribute to develop a more comprehensive model to describe formin's behaviour, especially how formin responds to mechanical forces in cells.