Fast Viral Dynamics Revealed by Microsecond Time-Resolved Cryo-EM

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Observing proteins as they perform their tasks has largely remained elusive, which has left our understanding of protein function fundamentally incomplete. To enable such observations, we have recently proposed a novel technique that improves the time resolution of cryo-electron microscopy (cryo EM) to microseconds [1-5]. We demonstrate for the first time that microsecond time-resolved cryo-EM enables observations of fast protein dynamics [6]. We use our approach to elucidate the capsid mechanics of cowpea chlorotic mottle virus (CCMV), whose large-amplitude motions play a crucial role in the viral life cycle [6]. We observe that a pH jump causes the extended configuration of the capsid to contract on the microsecond timescale. While this is a concerted process, the motions of the capsid proteins involve different timescales, leading to a curved reaction path.

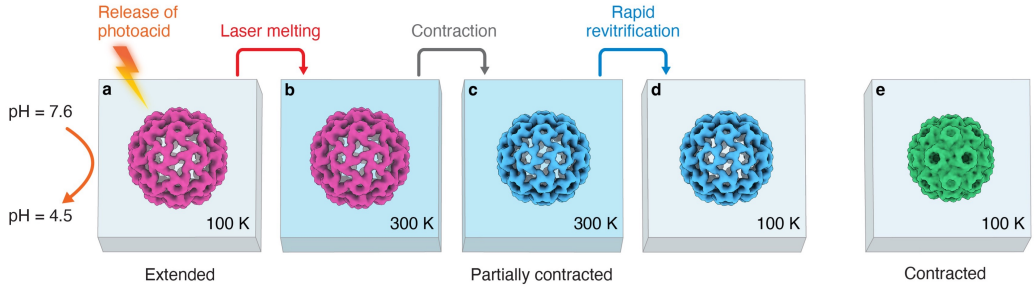


Fig. 1. Microsecond time-resolved cryo-EM of the CCMV contraction — experimental concept.

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