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Mechanoregulation of clathrin-mediated endocytosis in isolated cells and developing tissues

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Clathrin-coated assemblies bear the largest fraction of the endocytic load from the plasma membrane of eukaryotic cells. However, dynamics of clathrin-mediated endocytosis (CME) have not been established within tissues of multicellular organisms due to experimental and analytical bottlenecks in determining the lifespan of clathrin-coated structures. We found that clathrin coat growth rates obtained from fluorescence microscopy acquisitions can be utilized as reporters of CME dynamics. Growth rates can be assembled within time windows shorter than the average clathrin coat lifetime and, thereby, allow probing the changes in CME dynamics in real time. Furthermore, this novel approach is applicable to tissues as it is not prone to particle detection and tracking errors, which result in underestimation of the clathrin coat lifetimes. Exploiting these advantages, we detected spatial and temporal changes in CME dynamics within Drosophila amnioserosa tissues at different stages of embryo development. We also found that increased membrane tension impedes CME through inhibition of formation and dissolution of clathrin-coated structures. Therefore, the parameters defining clathrin coat dynamics (i.e., lifetime, formation density and growth rates) can be utilized to monitor the spatiotemporal gradients of the plasma membrane tension during cell migration and spreading.