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Coarsening of protein clusters on subcellular drops exhibits strong and sudden size selectivity AIDAN BROWN, ANDREW RUTENBERG, Dalhousie University — Autophagy is an important process for the degradation of cellular components, with receptor proteins targeting substrates to downstream autophagy machinery. An important question is how receptor protein interactions lead to their selective accumulation on autophagy substrates. Receptor proteins have recently been observed in clusters, raising the possibility that clustering could affect autophagy selectivity. We investigate the clustering dynamics of the autophagy receptor protein NBR1. In addition to standard receptor protein domains, NBR1 has a "J" domain that anchors it to membranes, and a coiled-coil domain that enhances self-interaction. We model coarsening clusters of NBR1 on the surfaces of a polydisperse collection of drops, representing organelles. Despite the disconnected nature of the drop surfaces, we recover dynamical scaling of cluster sizes. Significantly, we find that at a well-defined time after coarsening begins, clusters evaporate from smaller drops and grow on larger drops. Thus, coarsening-driven size selection will localize protein clusters to larger substrates, leaving smaller substrates without clusters. This provides a possible physical mechanism for autophagy selectivity, and can explain reports of size selection during peroxisome degradation.

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