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Dynamic maintenance of stochastic molecular clusters on cell membranes ANDREW MUGLER, Purdue University, MARTIJN WEHRENS, PIETER REIN TEN WOLDE, FOM Institute AMOLF — Clustering of molecules on cell membranes is a widely observed phenomenon. A key example is the oncoprotein Ras. Maintenance of Ras clusters has been linked to proper Ras signaling. Yet, the mechanism by which Ras clusters are maintained remains unclear. Recently it was discovered that activated Ras promotes further Ras activation. We show using particle-based simulation that this positive feedback link is sufficient to produce persistent clusters of active Ras molecules via a dynamic nucleation mechanism. The cluster statistics are consistent with experimental observations. Interestingly, our model does not support a Turing regime of macroscopic reaction-diffusion patterning. This means that the clustering we observe is a purely stochastic effect, arising from the coupling of the positive feedback network with the discrete nature of individual molecules. These findings underscore the importance of stochastic and dynamic properties of reaction diffusion systems for biological behavior.

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