

The Unforeseen Challenge: From Genotype-to-Phenotype in Cell Populations

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ABSTRACT

The emergence of stable cell states depends on genotype-to-phenotype associations, which essentially reflect the organization of gene regulatory modes. We have developed an experimental framework, in which cell populations are exposed to unforeseen challenges; novel perturbations they had not encountered before along their evolutionary history. This approach allows an unbiased view of cell dynamics, uncovering the potential of cells to evolve and develop adapted stable states. In the last decade, our experiments have revealed a coherent set of observations within this framework, painting a picture of the living cell that in many ways is not aligned with the conventional one. Of particular importance is our finding that adaptation of cell-state organization is essentially an efficient exploratory dynamical process rather than one founded on random mutations. I'll discuss the main results of our experiments and their implications on the conceptual understanding of cell-state organization in diverse biological contexts.