

Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

The role of spatial asymmetries in the development of the bacterium *Caulobacter crescentus* CAROLINA TROPINI, ERIN CHEN, STEPHEN SCIOCHETTI, AUSTIN NEWTON, MICHAEL LAUB, KERWYN CASEY HUANG — *Caulobacter* is a model organism for cell cycle regulation and development. Upon division it differentiates into a sessile stalked cell and a motile swarmer cell. Throughout the cell cycle, the localization of several key proteins is highly regulated. We address the importance of spatial localization in signal transduction and development. Flagellar pole development is controlled by the response regulator DivK, whose phosphorylation state is controlled by the kinase DivJ and the phosphatase PleC. PleC localizes to the swarmer pole, while DivJ localizes at the stalked pole. We have constructed strains with a variety of PleC and DivJ localization patterns. Our results indicate that localization is not absolutely necessary in this system, rather localized proteins enhance the robustness to fluctuations. We further investigate the importance of spatial asymmetries in the regulation of the master cell-cycle-regulator CtrA. In its phosphorylated form, CtrA binds to the replication origin in *Caulobacter* in a highly cooperative fashion, and prevents DNA replication. The CtrA distribution is tightly controlled not only by localized phosphorylation and dephosphorylation but also synthesis and degradation. We find that physiological degradation rates exert only a small perturbation on the distribution generated by asymmetric phosphorylation.

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Date submitted: 24 Nov 2009

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