

## The Bacterial Cytoplasm Has Glass-like Properties and Is Fluidized by Metabolic Activity

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2015/01/16

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### Abstract:

Unlike eukaryotes, bacteria do not have cytoskeletal motor proteins and mainly rely on the physical properties of the cytoplasm that determine the dynamics of cytoplasmic components and therefore contribute to all intra-cellular processes. The interior of cells is quite crowded and such a cytoplasmic environment has been suggested to constrain the motion of cytoplasmic components. On the other hand, metabolic activities (active processes) drive the cytoplasm far from thermodynamic equilibrium and can facilitate the diffusion of macromolecules. However, how these exclusive features coexist and affect intra-cellular processes is poorly understood.

In the paper by Parry *et al.*, “*The Bacterial Cytoplasm Has Glass-like Properties and Is Fluidized by Metabolic Activity*”, *Cell*, **156**:183-194, 2014 [1], they reported that the bacterial cytoplasm displays a glassy behavior similar to colloidal glasses observed in a crowded condition [2]. Furthermore, they discovered that cytoplasmic fluidity and dynamics change as cells shift between metabolically active and dormant states in response to fluctuating environments. In this JC, I review [1] and finally discuss biological significances and universality of such “cytoplasmic active glasses”.

### References:

1. Parry, B.R., Surovtsev, I.V., ..., Jacob-Wagner, C. (2014). The Bacterial Cytoplasm Has Glass-like Properties and Is Fluidized by Metabolic Activity. *Cell*, **156**, 183-194.
2. Hunter, G.L., and Weeks, E.R. (2012). The Physics of The Colloidal Glass Transition. *Rep Prog Phys* **75**, 066501.