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Diffusive Dynamics of Bacterial Proteome as a Proxy of Cell Death

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Temperature variations have a big impact on the bacterial metabolism and death, yet an exhaustive molecular picture of these processes is still missing. For instance, whether the thermal death is determined by the deterioration of the whole or a specific part of the proteome is hotly debated. In our work, by monitoring the proteome dynamics of *E. coli* we show that only a minor fraction of the proteome unfolds at the cell death. First, we prove that the dynamical state of the *E. coli* proteome is an excellent proxy for the temperature dependent bacterial metabolism and death. The proteome diffusive dynamics peaks at about the bacterial optimal growth temperature, then a dramatic dynamical slowdown is observed which starts just below the cell's death temperature. Next, we show that this slowdown is caused by the unfolding of just a small fraction of proteins which establish an entangling inter-protein network—dominated by hydrophobic interactions—across the cytoplasm. Finally, we prove that the deduced progress of the proteome unfolding and its diffusive dynamics are both key to correctly reproduce the *E. coli* growth rate.

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