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Engineered protein nanopores for challenging tasks in molecular diagnosis

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Protein nanopore-based sensing elements represent a pressing need in molecular biomedical diagnosis. However, the integration of protein nanopores with other solid-state nanofluidic devices is a challenging task. This is especially true if we consider that isolated single proteins are in general fragile and unstable under harsh conditions of detection. Here, I will present a strategy for improving the stability of a redesigned nanopore using ferric hydroxamate uptake component A (FhuA), a beta-barrel membrane protein channel of E. coli. The primary function of FhuA is to facilitate the energy-driven, high-affinity Fe3+ uptake complexed by the siderophore ferrichrome. The key ingredient of this strategy was the coupling of direct genetic engineering of FhuA with a fast-dilution refolding approach to obtain an unusually stable protein nanopore under a broad range of experimentation. These advantageous characteristics were recently demonstrated by examining proteolytic activity of an enzyme at a highly acidic pH, a condition at which majority of beta-barrel protein nanopores are normally gated or unfolded. Future membrane protein design work will not only reveal a better understanding of the processes employed in membrane protein folding and stability, but will also serve as a platform for the integration of robust protein components into devices.

Biography

Liviu Movileanu studied physics (1985-1990) and received the PhD degree in Biophysics from the University of Bucharest (1997). He held Postdoctoral positions at the University of Missouri (Kansas City, USA, 1997-1998) and the Texas A&M University Health Science Center (College Station, Tex, USA, 1999-2004). Currently, he is as an Associate Professor of physics at Syracuse University (Syracuse, New York, NY, USA). He has published about 60 papers in international scientific journals and has delivered about 130 invited talks worldwide. His research group is funded by the US National Institutes of Health. His research areas include single-molecule and membrane biophysics, chemical and synthetic biology, bionanotechnology and nanomedicine, biosensors and functional biomaterials, biological statistics, and numerical analysis of stochastic biological processes.

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