

Engineered nanopores for protein detection

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A nanopore may act as an amazingly versatile single-molecule probe that can be employed to reveal several important features of nucleic acids and proteins. The underlying principle of nanopore probe techniques is simple: the application of a voltage bias across an electrically insulated membrane enables the measurement of a tiny picoamp-scale transmembrane current through a single hole of nanometer size, called a nanopore. Each molecule, translocating through the nanopore, produces a distinctive current blockade, the nature of which depends on its biophysical properties as well as the molecule-nanopore interaction. Such an approach proves to be quite powerful, because single small molecules and biopolymers are examined at very high spatial and temporal resolutions. I will discuss our recent work that provided a mechanistic understanding of the forces that drive protein translocation through a nanopore. These measurements facilitate the detection and exploration of the conformational fluctuations of single molecules and the energetic requirements for their transition from one state to another. I will also describe our recent strategies for engineering new functional nanopores, in organic and silicon-based materials, with properties that are not encountered in nature. From a practical point of view, this methodology shows promise for the integration of engineered nanopores into nanofluidic devices, which would provide a new generation of research tools in nanomedicine and high-throughput devices for molecular biomedical diagnosis.

Biography

Liviu Movileanu studied physics (1985-1990) and received a PhD in Biophysics from the University of Bucharest (1997). He held postdoctoral positions at the University of Missouri (Kansas City, Missouri, 1997-1998) and the Texas A&M University Health Science Center (College Station, Texas, 1999-2004). He is currently an Associate Professor of Physics at Syracuse University (Syracuse, New York). His research areas include single-molecule and membrane biophysics, chemical and synthetic biology, bionanotechnology and nanomedicine, biosensors and functional biomaterials.

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