

DNA gripped in nanopores

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Molecular biologists, including the cool dudes from CSI, use gel electrophoresis to separate DNA fragments from each other in order to analyze the DNA. A team of researchers under the leadership of Vici winner Serge Lemay, has now shown for the first time how the gel influences the movement of the DNA. The researchers drove a single DNA molecule through a nanopore in order to analyze the forces on the DNA. The results of the research were published on March 29 in *Nature Physics*.

The movement of DNA under the influence of an electric field, electrophoresis, is caused by negatively charged groups in the basic structure of the DNA. These negative charges are shielded by positive ions, that accumulate in a layer around the DNA. These ions retard the movement of DNA under the influence of an electric field. The electrostatic forces and counteracting [friction](#) of the gel are inextricably linked to each other. Therefore up until now it seemed impossible to investigate these two factors independently.

Combination of technologies

The researchers developed nanopores with different dimensions in order to vary the spatial confinement of the DNA. They then used an optical pincer to grab a Perspex ball to which the DNA was linked. In this way they pulled the DNA molecule through a nanopore. The various dimensions of the holes offered them a direct look at the hydrodynamic linkage between DNA and the nanopore.

The measurements revealed that the retarding forces exerted by the [ions](#), slowly decreased if the DNA moved through a larger nanopore. The bigger the pore the smaller the [resistance](#). Calculations based solely on electrostatic forces had yielded other expectations. The hydrodynamic environment was found to exert a greater influence than had been expected.

The team used a unique combination of different techniques. This combination formed a good basis for highly promising developments in single molecule techniques based on nanopores. For example, such techniques render the detailed detection of the interaction between proteins and DNA possible.

More information: Origin of the electrophoretic force on DNA in solid-state nanopores. *Nature Physics*, Stijn van Dorp, Ulrich F. Keyser, Nynke H. Dekker, Cees Dekker, Serge G. Lemay.

Source: Netherlands Organization for Scientific Research

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