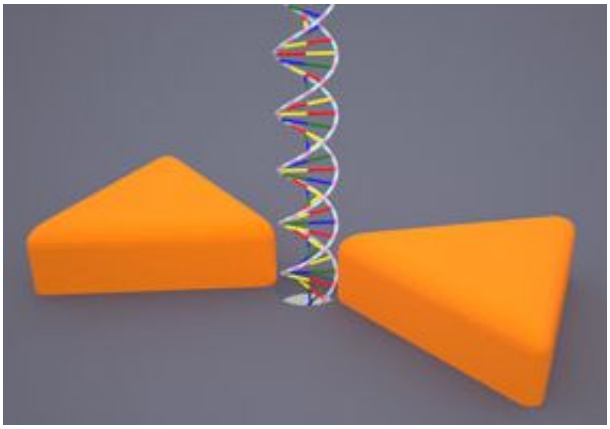
Nanopores light up for reading out DNA

September 12 2013



Artist impression of a nanopore with Plasmonic antennas.

Nanopores are ideally suited for threading DNA molecules through them, enabling the genetic code to be read out. Researchers from TU Delft want to make this technology even more powerful by equipping the pores with 'plasmonics'. By utilising minuscule optical 'antennas', it is possible to focus light precisely and intensely on the nanopore. Eventually, the researchers hope to use this technique to control DNA and read it out efficiently.

Reduced costs

The costs for producing a readout of the human genome (our DNA) have fallen significantly in the past decade, but the technology has remained relatively expensive. Nanopores in silicon chips are a suitable candidate

for a new generation of DNA sequencers. A decade ago, research by scientists from TU Delft and Harvard University was at the forefront of this technology.

Optical 'antennas'

Together with colleagues from the University of Illinois (USA), the TU Delft scientists now want to go a step further: they are equipping the nanopores with 'plasmonics', minuscule optical 'antennas'. These are used to focus light to an highly intense and extremely small 'hot spot' in the nanopore. In doing so, the researchers hope to be able to capture, slow down and read out the DNA efficiently.

The research is being funded by the American National Institute of Health (NIH) to the amount of 2.47 million dollars. It is part of a cluster of eight funded research projects worth 17 million dollars, as announced this week by the NIH.

Sensitive sensor

"Reading the base pairs in DNA with current sequencing technology is expensive. You need to label the DNA and only very short pieces of DNA can be read out, approximately a few hundred base pairs," says professor Cees Dekker, head of the research project and director of the Kavli Institute of Nanoscience at TU Delft. "Nanopores offer the possibility of reading out very long strands of DNA in a single go. By equipping the nanopores with plasmonics, we hope to integrate a new ultrasensitive type of sensor precisely on the spot of the nanopore."

Lycurgus Cup. Credit: Brittish Museum

A thousand times stronger

Dekker's research group and the colleagues in Illinois are the first to combine both fields of study. "We make minuscule plasmonic antennas: metal structures on which you can focus electrons with the help of light. By placing these tiny antennas around the nanopore, we're able to 'light up' the pore. At precisely this spot, the light intensity is focused a thousand times stronger. And in doing so, we think we can control the DNA molecule and at the same time read it out," explains post-doc Magnus Jonsson.

Roman art

Research in both the fields of nanopores and plasmonics is evolving rapidly. Plasmonics is a relatively recent field of study, but according to Dekker the use of plasmonic materials has been around for years. "Roman artists in the fourth century were already using gold and silver dust in glass. A fine example of this is the Lycurgus Cup, which is either red or green depending on the fall of light. This is also plasmonics. The effect has therefore been used for millennia, even though we only found

out recently how it works."

Provided by Delft University of Technology

Citation: Nanopores light up for reading out DNA (2013, September 12) retrieved 20 March 2024 from https://phys.org/news/2013-09-nanopores-dna.html

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.