# Harvard's graphene DNA sequencing licensed

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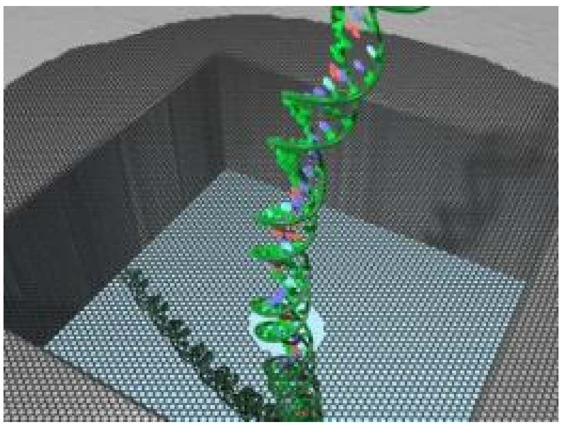

A nanopore is created in graphene to form a trans-electrode, measuring variations in current as a single DNA molecule passes through the pore. Credit: iemedia solutions/ONT

Oxford Nanopore Technologies today announced an exclusive agreement with Harvard University's Office of Technology Development for the development of graphene for DNA sequencing. Graphene is a robust, single atom thick 'honeycomb' lattice of carbon with high electrical conductivity. These properties make it an ideal material for high resolution, nanopore-based sequencing of single DNA molecules.

Under the terms of the agreement, Oxford Nanopore has exclusive rights to develop and commercialize methods for the use of graphene for the analysis of DNA and RNA, developed in the Harvard laboratories of Professors Jene Golovchenko, Daniel Branton, and Charles Lieber. The agreement adds to an existing collaboration between Oxford Nanopore and Harvard that spans basic methods of nanopore sensing through to the use of solid-state nanopores. Oxford Nanopore will also continue to support fundamental nanopore research at Harvard.

"Graphene is emerging as a wonder material for the 21st century and recent research has shown that it has transformative potential in DNA sequencing." said Dr Gordon Sanghera, CEO of Oxford Nanopore Technologies. "The groundbreaking research at Harvard lays the foundation for the development of a novel solid-state DNA sequencing device. We are proud to partner with the research team that pioneered early nanopore discoveries and continues to break boundaries with new materials and techniques.

"Oxford Nanopore is probably best known for protein nanopores," continued Dr Sanghera. "However, today's agreement highlights that we are increasing our investment in solid-state nanopores by adding graphene to our existing portfolio of solid-state nanopore projects and collaborations."

In a landmark 2010 *Nature* publication (S. Garaj et al, *Nature* Vol 467,doi:10.1038/nature09379) the Harvard team and collaborators used graphene to separate two chambers containing ionic solutions, and created a hole - a nanopore – in the graphene. The group demonstrated that the graphene nanopore could be used as a trans-electrode, measuring a current flowing through the nanopore between two chambers. The trans-electrode was used to measure variations in the current as a single molecule of DNA was passed through the nanopore. This resulted in a characteristic electrical signal that reflected the size and conformation of the DNA molecule.

At one atom thick, graphene is believed to be the thinnest membrane able to separate two liquid compartments from each other. This is an important characteristic for DNA sequencing; a trans-electrode of this thickness would be suitable for the accurate analysis of individual bases on a DNA polymer as it passes through the graphene.

Nanopore techniques aim to improve substantially the cost, power and complexity of DNA sequencing. While first generation technologies in development at Oxford Nanopore use nanopores made by porous proteins, subsequent generations will use synthetic 'solid-state' materials such as silicon nitride. However, at this time challenges remain in industrial fabrication of synthetic nanopores with the required dimensions and electronic properties. Graphene offers a potential solution due to its strength, dimensions, electrical properties and future potential for low-cost manufacturing.

**More information:** Graphene as a subnanometre trans-electrode membrane, S. Garaj, W. Hubbard, A. Reina, J. Kong, D. Branton & J. A. Golovchenko. *Nature* Vol 467,doi:10.1038/nature09379 (Sept 2010)

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