DNA double helix measurements

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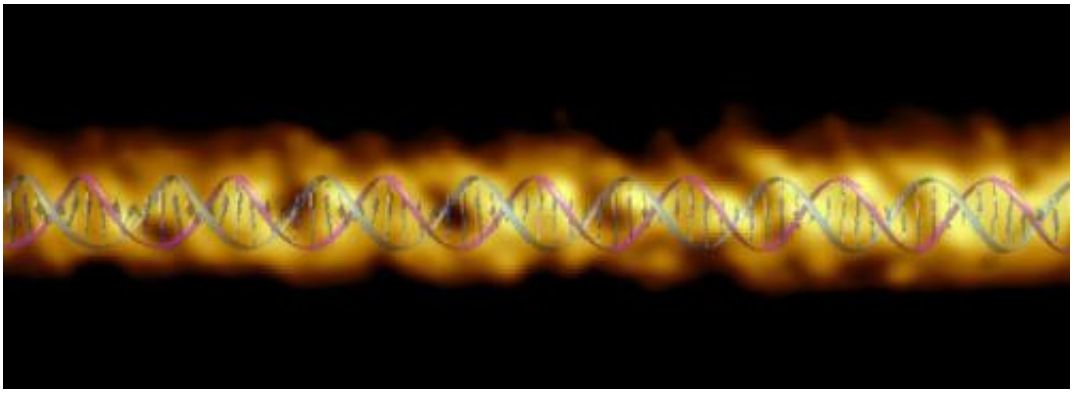

An image of the DNA double helix structure taken with the AFM, overlaid with the Watson-Crick DNA structure

Researchers at the National Physical Laboratory (NPL) and the London Centre for Nanotechnology (LCN) have determined the structure of DNA from measurements on a single molecule using atomic force microscopy (AFM), and found significant variations in the well-known double helix.

The collaborative project applied a technique known as 'soft-touch' atomic force microscopy to large, irregularly arranged and individual DNA molecules. In this form of microscopy, a miniature probe is used to feel the surface of the molecules one by one, rather than seeing them.

To demonstrate the power of the method, the research team measured the structure of a single DNA molecule, finding on average good

agreement with the structure first suggested by Watson and Crick in 1953. Strikingly, however, the single-molecule images also reveal significant variations in the depths of grooves in the double helix structure.

DNA contains the hereditary information for cells, and our lives depend on the molecular machinery that is continuously at work in our bodies. The structure of these nanometre-scale machines is at the heart of our understanding of health and disease, and the DNA double helix has been the key to understanding how genetic information is stored and passed on.

While the origin of the observed variations in the DNA structure is not yet fully understood, it is known that these grooves act as keyways for proteins (molecular keys) that determine to which extent a gene is expressed in a living cell. Accurate measurements allow us to observe the variations in these key ways, which may then help us to determine the mechanisms by which living cells promote and suppress the use of genetic information stored in their DNA.

More information: Pyne, A., Thompson, R., Leung, C., Roy, D. and Hoogenboom, B. W. (2014), "Single-Molecule Reconstruction of Oligonucleotide Secondary Structure by Atomic Force Microscopy." *Small*. doi: 10.1002/smll.201400265

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