Uniform long DNA for applications in Nanoelectronics

Could DNA based nanoscale electronic components replace the microelectronics industry as the technology of the future?

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DNA is a blueprint of the genetic code in all living organisms. The self-assembly properties of DNA can be used to build nanoscale objects in all three dimensions. DNA can act as a scaffold onto which we can attach additional functionality, such as electrical conductivity. However the synthesis of long uniform strands of DNA is not straightforward. This project investigated enzymatic pathwayws to produce repeat seqyences of DNA.

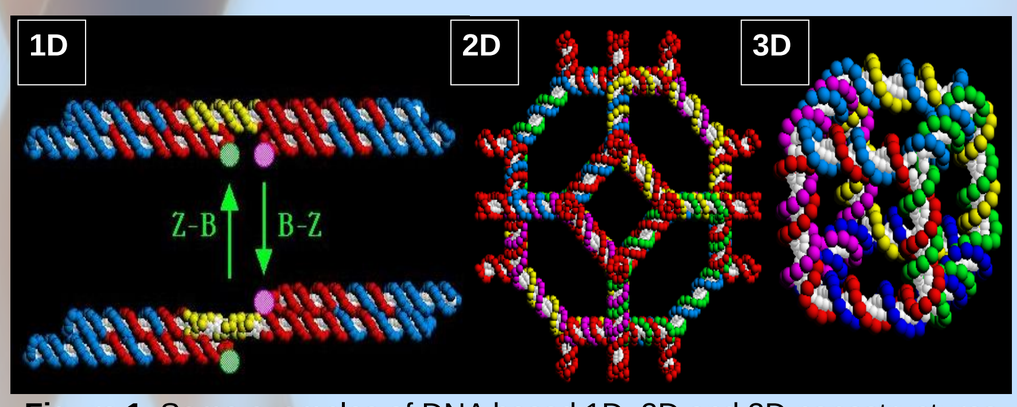


Figure 1. Some examples of DNA based 1D, 2D and 3D nanostructures

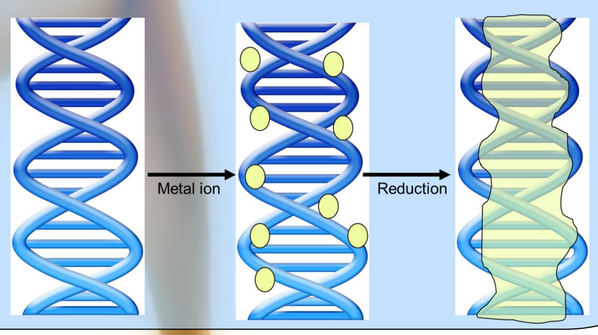
iNanotechnology

Nanoscience is the study of very small objects in the 1-100 nm range. A nanometre is only one billionth of a metre. The science of nanotechnology is a way of creating unique new devices with novel properties that are on the nanoscale. DNA is a particularly useful biomolecule for templated growth of nanowires due to its nanoscale dimensions.

The main aims of the project were to be able to synthesise using enzyme-controlled reactions poly d(GC) DNA strands of up to 15 kilo base pairs in length. Also once the DNA was synthesised, the other goal of the project was to remove from the DNA any incomplete sequences and the reagents needed to synthesise and visualise the DNA. This would then provide a pure source of uniform DNA for nanowire generation

Nanowire

The DNA was produced using enzyme-controlled reactions brought about by the Klenow exo- fragment and a (GC)10 DNA primer template. Once the DNA had been prepared, it was then electrophoresed, stained via Ethidium Bromide and visualised using ultraviolet light in order to asess the length of the strand. The DNA was purified using one of the three methods (Electroelution, dialysis and spin columns) in order to remove the contaminants and achieve a pure DNA strand.



Conclusions Poly-d(GC) strands were synthesized, but not at a length anywhere near 15kbp. The maximum size of the DNA synthesised tended to range between 500 base pairs and 1 kbp. Unfortunately, during the project I was unable to find a solution to this problem. For the second aim of the project, three different methods were used in order to purify the DNA; Electroelution, Dialysis and Spin Columns. By the end of the project, all three methods had successfully purified the DNA from the contaminants. However, the DNA recovered from these methods was not of a sufficient yield for nanowire formation.