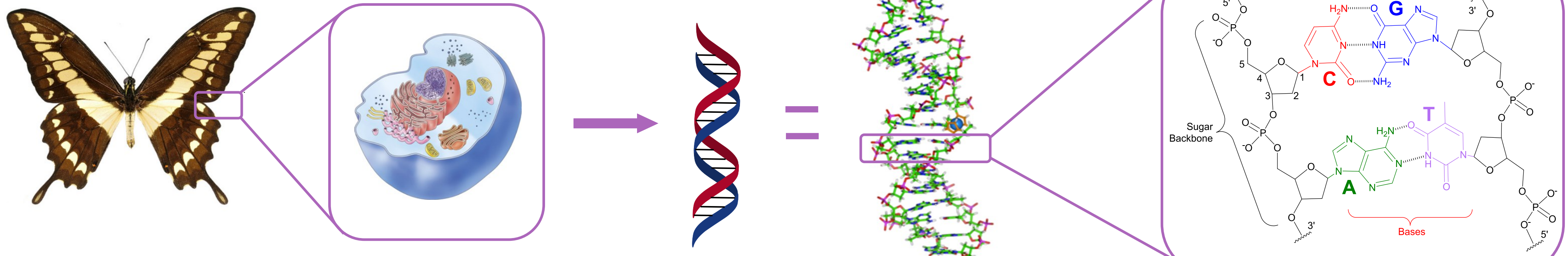


Electrifying Modified DNA: Disease Detection

H. V. Roberts, V. H. Nguyen, S. Horswell and J. H. R. Tucker*
School of Chemistry, hve993@bham.ac.uk, j.tucker@bham.ac.uk*

Cancer is one of the biggest health concerns today. DNA strands where the sequence has changed can be indicative of the disease. This project aims to detect changes in DNA sequence using Ferrocene, an iron based compound. It is easily manufactured within the lab, is stable and non-toxic. These qualities make it an excellent candidate for DNA sensing.

What is DNA?



Changes in the DNA Sequence

Could we use these differences to detect diseases quickly? Variations in DNA sequences have been linked to diseases. For example:

Healthy Tissue Sequence:

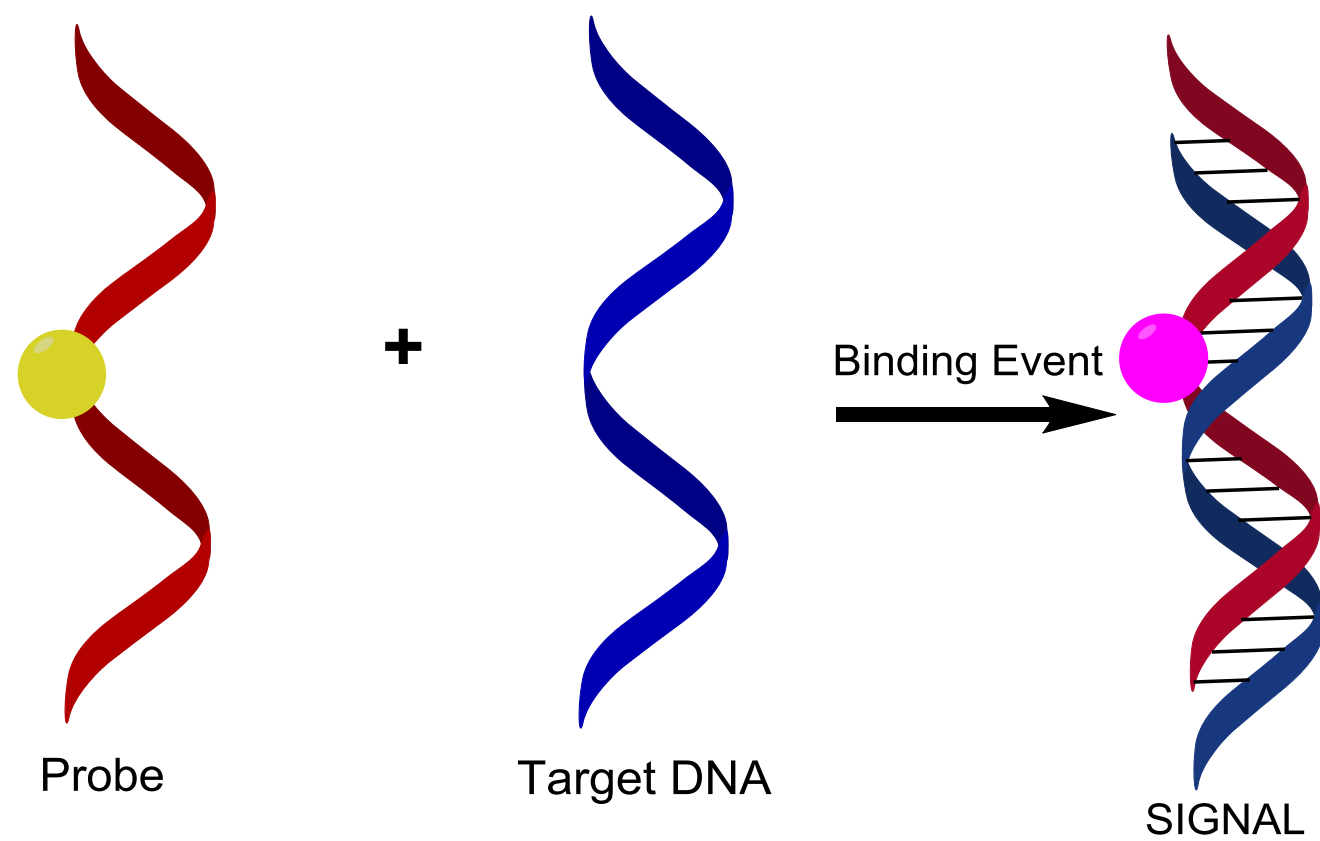
AAA **A** CTTGTGGTAGTTG **G** AGCT GATGGCG **T**

Colorectal Cancer Tissue Sequence:

AAA **T** CTTGTGGTAGTTG **T** AGCT GATGGCG **C**

How is DNA Detected?

- Probe binds to DNA which has a sequence of matching bases.



- On binding the local environment changes. This produces a signal.

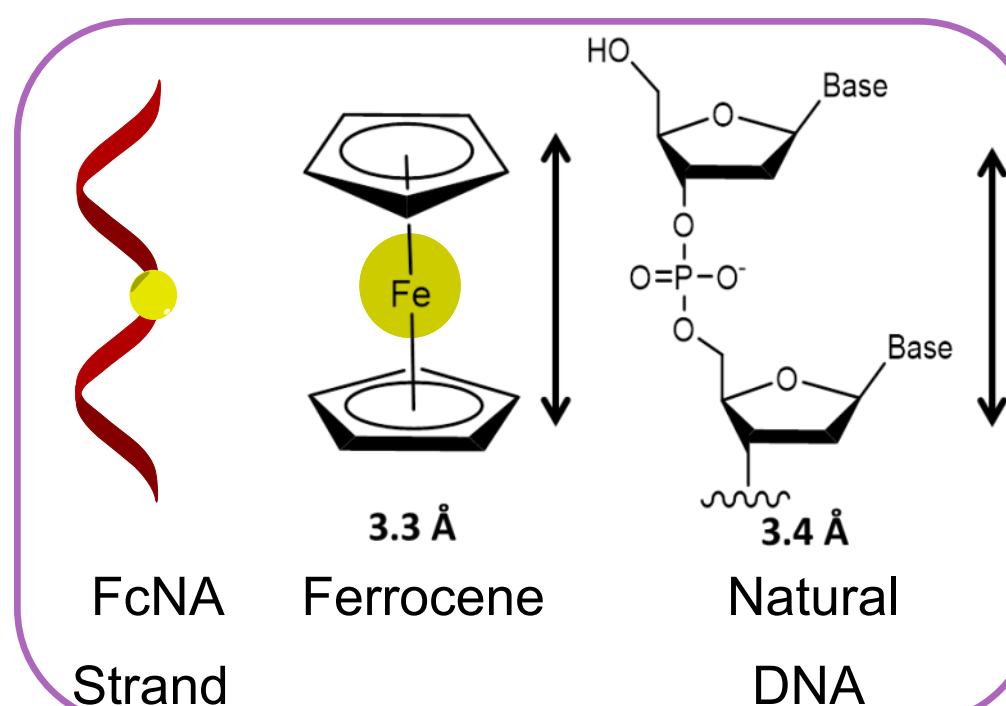
Would the signal be different if the sequence variations are

Why use Ferrocene as a Reporter?

- Can be incorporated into a DNA strand (called FcNA).

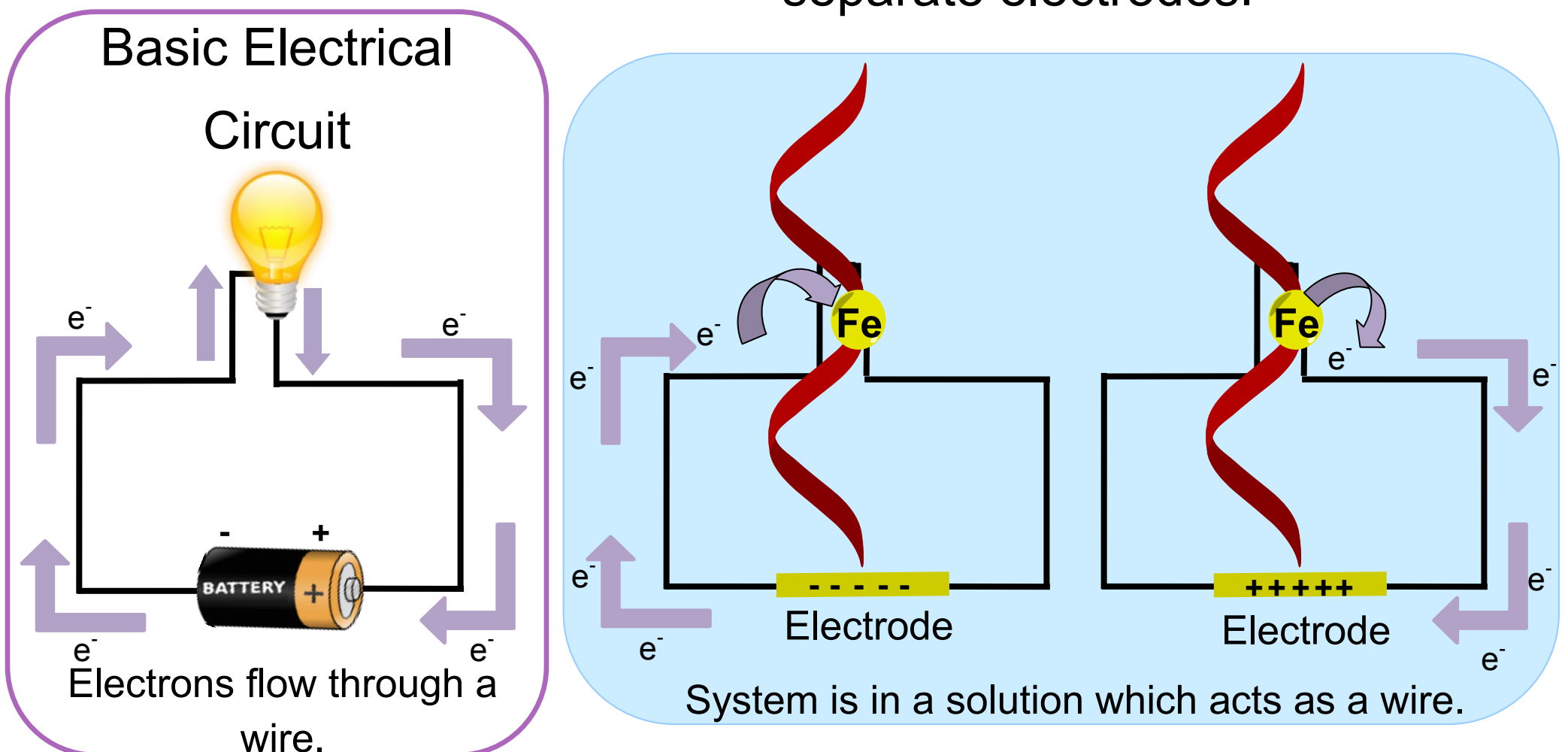
- Iron (Fe) atom can form part of an electrical circuit.

Will ferrocene detect a DNA strand?



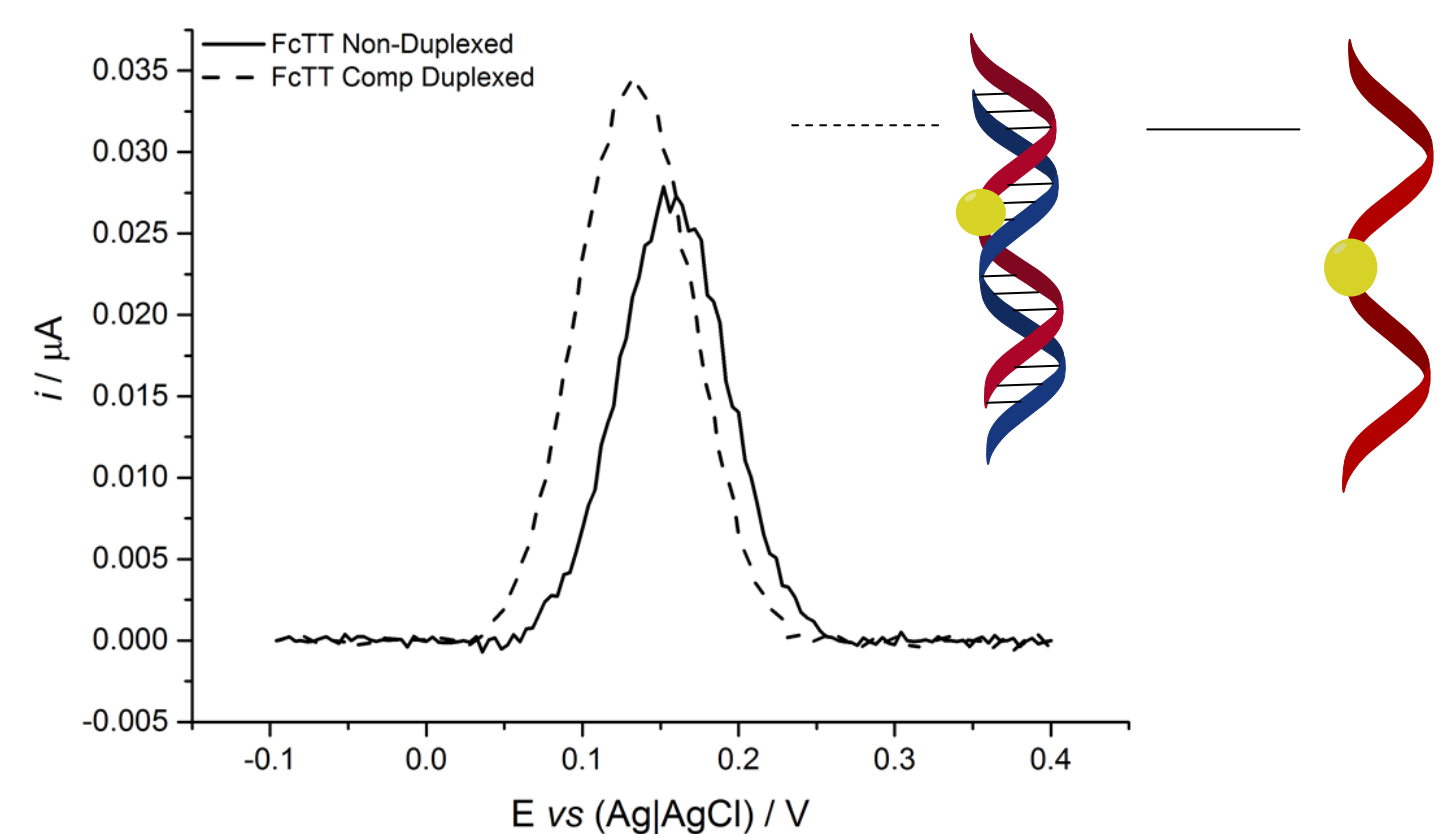
Electrifying DNA

Same principle as a simple electrical circuit except the positive and negative parts of the battery are now on separate electrodes.



The electrode shown above can now be positively or negatively charged allowing electrons to move around the circuit. Movement of electrons is called current.

Results



Square Wave Voltammograms recorded at 30 Hz, 10 mM Phosphate Buffer pH 7, 1 M NaClO₄, MCH conc: 2 mM, FcNA conc: 1 μM Target DNA: 100 nM

Current has increased by 32% on binding a strand of DNA.
DNA detection is possible with the FcNA Probe.

Work will now focus on detecting sequence differences.

References

H. V. Nguyen, Z. Zhao, A. Sallustrau, S. L. Horswell, L. Male, A. Mulas, and J. H. R. Tucker, Chem. Commun., 2012, 48, 12165–12167.

Acknowledgements

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