RNA logic gates

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1 Introduction

Logic circuits using DNA and RNA has many interesting applications in diagnostics and treatment. An example is cancer detection, where miRNA's can be used as biomarkers [2]. These biomarkers can be used as inputs for logic circuits, which can be designed to activate FRET signals [3] or enzymes [1] when combinations of biomarkers are present or absent. For example, a circuit could be designed to activate when 2 unique miRNA's are present at the same time, or when a certain protein is present. This is represented schematically in figure 1.

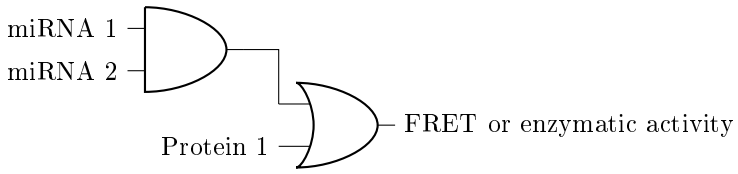

Figure 1: Example of logic circuit

The logic gates can be made using strand displacement [4], where the outputs of one gate can be linked to the input of another by unique DNA or RNA sequences.

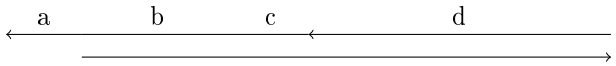

Figure 2: Example of logic circuit

References

[1] W Engelen, B M G Janssen, and M Merkx. DNA-based control of protein activity. *Chemical communications (Cambridge, England)*, 52(18):3598–3610, 2016.

[2] Yong Peng and Carlo M Croce. The role of MicroRNAs in human cancer. *Signal Transduction and Targeted Therapy*, 1:15004, jan 2016.

[3] Georg Seelig, David Soloveichik, David Yu Zhang, and Erik Winfree. Enzyme-Free Nucleic Acid Logic Circuits. *Science*, 314(5805):1585–1588, 2006.

[4] David Yu Zhang and Georg Seelig. Dynamic DNA nanotechnology using strand-displacement reactions. *Nature chemistry*, 3(2):103–113, 2011.