

Honours project

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Adsorption models of microarrays

Microarrays are experimental devices designed to determine which genes are expressed in biological samples by detecting the presence of messenger RNA. They are “high throughput” devices, capable of testing thousands of genes in a single experiment by hybridising target RNA in the biological sample onto single strand DNA probes fabricated on the microarray surface.

We have developed a physical theory of hybridisation at the microarray surface based on Langmuir adsorption theory with the ultimate aim of developing a practical algorithm to enable biologists to estimate absolute RNA concentrations. One part of the theory which requires further development is to understand the effect of interactions between the DNA probes. The problem boils down to a 2-dimensional statistical mechanics problem, which has so far proved to be analytically intractable, but in any case could be analysed with a Monte-Carlo simulation.

The current state of the problem is described in Appendix C of our paper “Adsorption models of hybridization and post-hybridization behaviour on oligonucleotide microarrays”, *J. Phys.: Condens. Matter* **18** (2006) 5545-5565, at <http://www.iop.org/EJ/abstract/0953-8984/18/23/024>

