School of Physics & Astronomy
FACULTY OF MATHEMATICS AND PHYSICAL SCIENCES

UNIVERSITY OF LEEDS

Transport and Concentration of Charged Molecules in a Lipid Membrane

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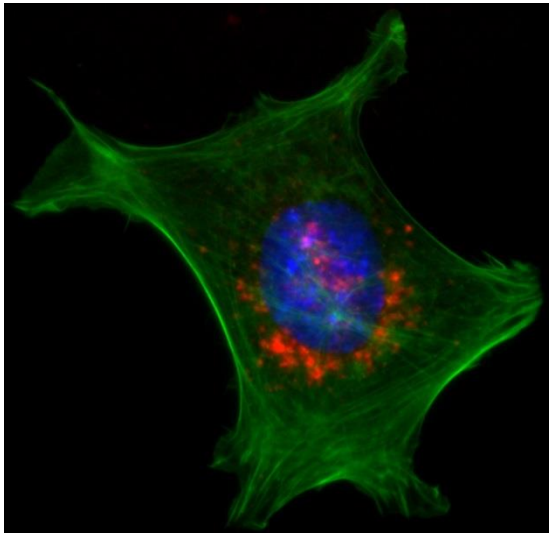
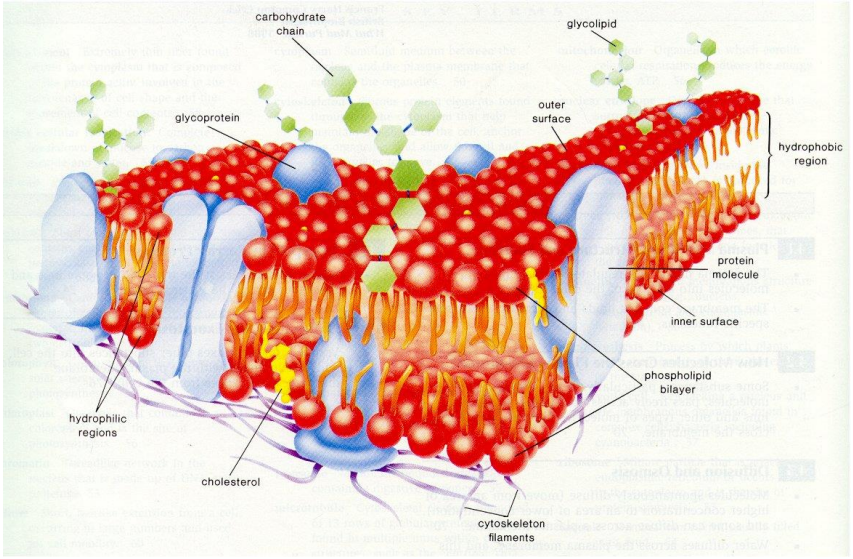
COMSOL CONFERENCE 2014 CAMBRIDGE

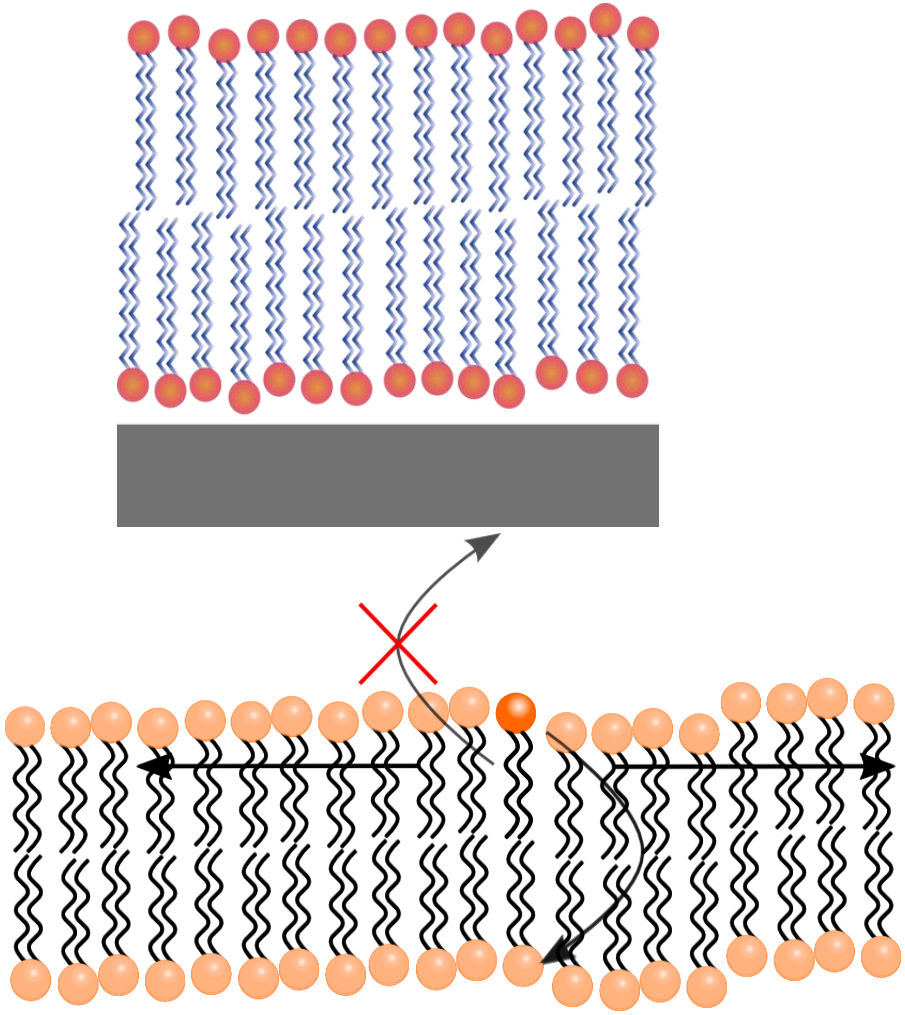
- Cell membranes play important roles
- Membrane proteins targets for most drugs but poorly understood





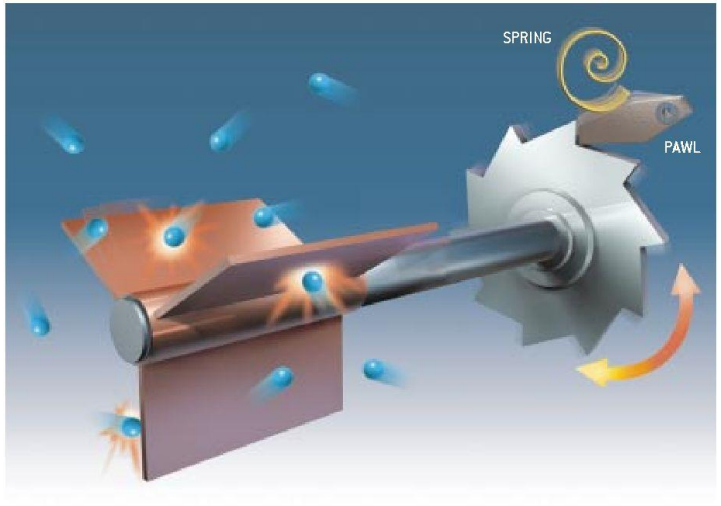
- Model system for cell membrane:

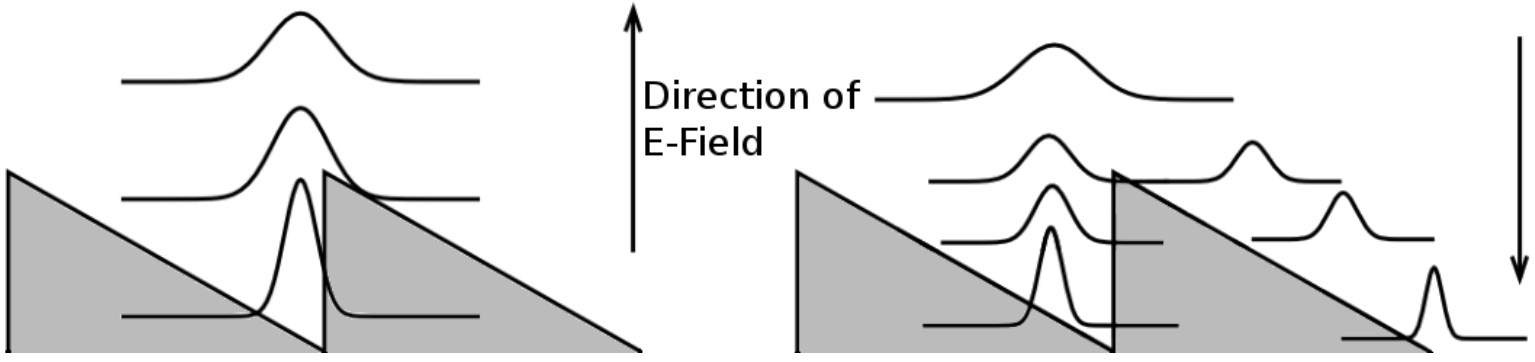
  Supported lipid bilayer



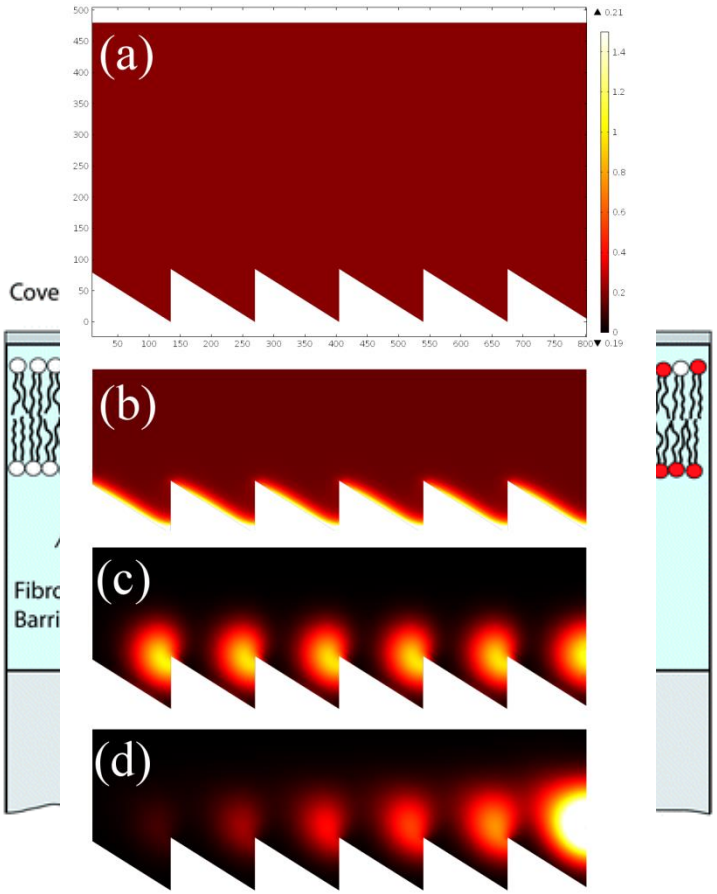
- 2D diffusion

Achieving Transport in a Membrane: Brownian Ratchets





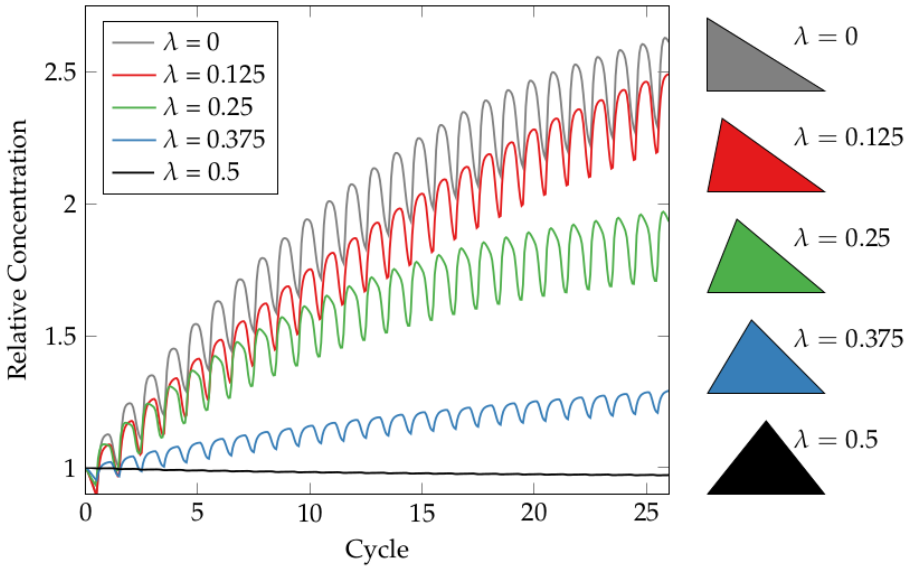
Brownian Ratchets in Lipid Membranes:

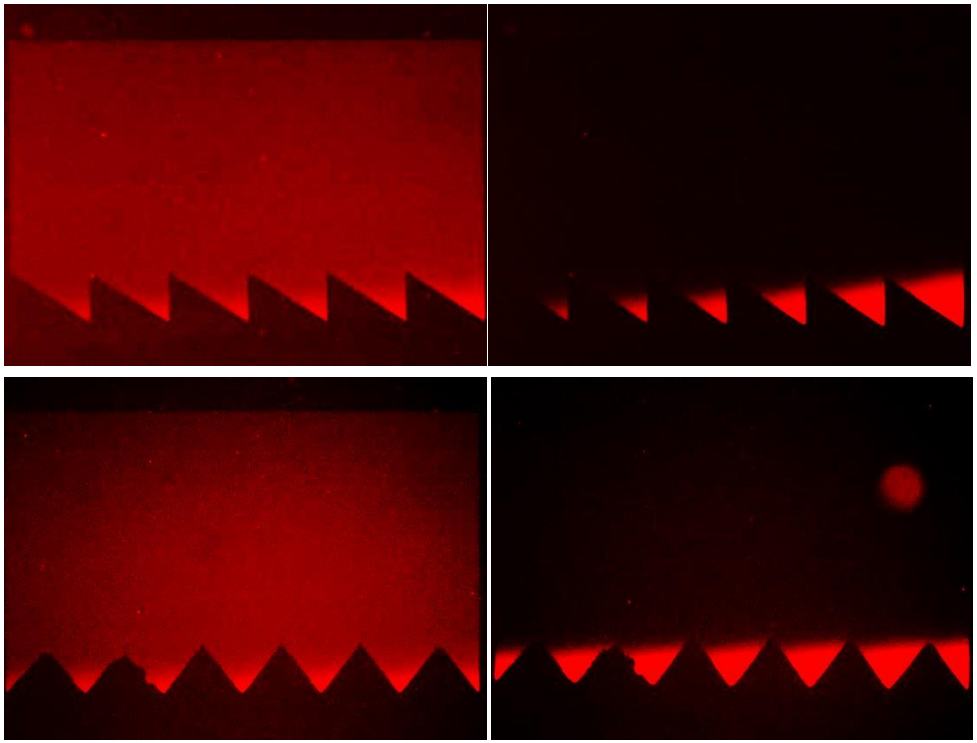


Side view Top view

Top view

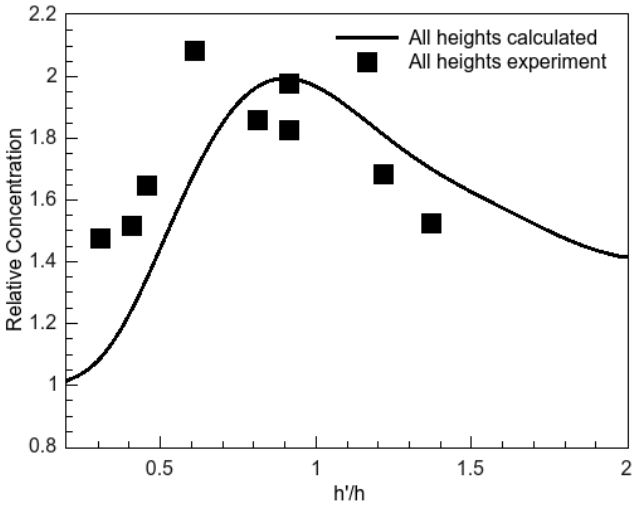
Optimising Transport in Brownian Ratchets:

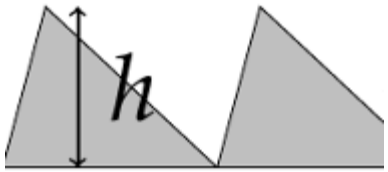


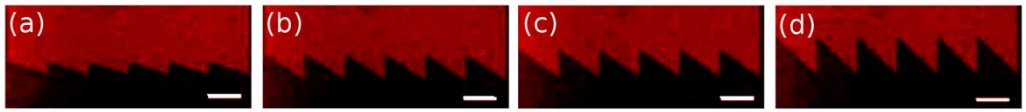


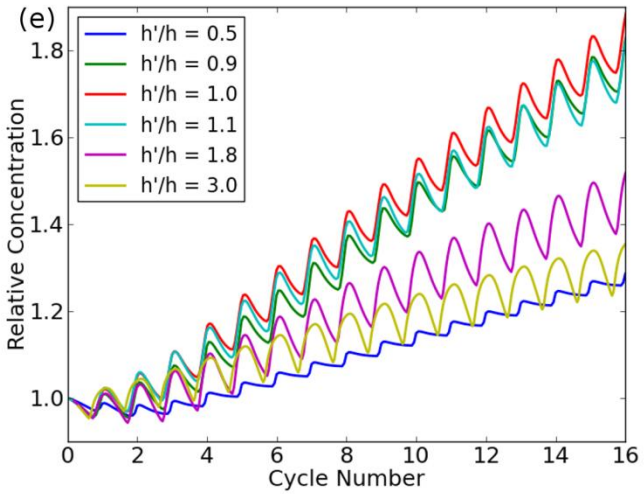
Further optimisation:

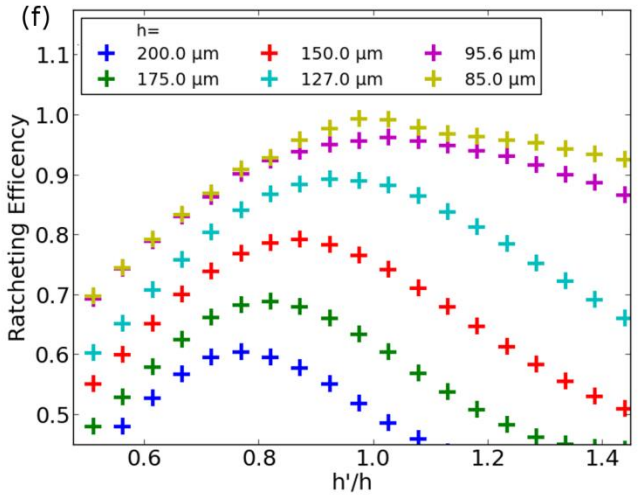
- Ratchet height & period of e-field
- h’ = average distance travelled
- Normalise to h’/h



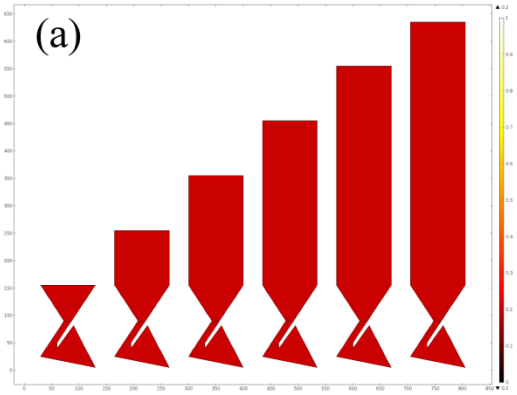




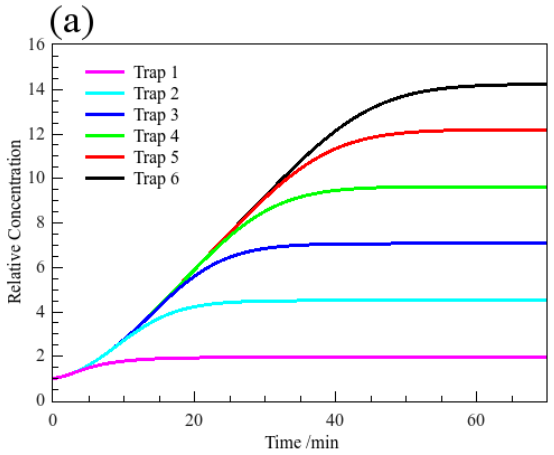




A DC Approach to Concentration and Trapping



E-Field



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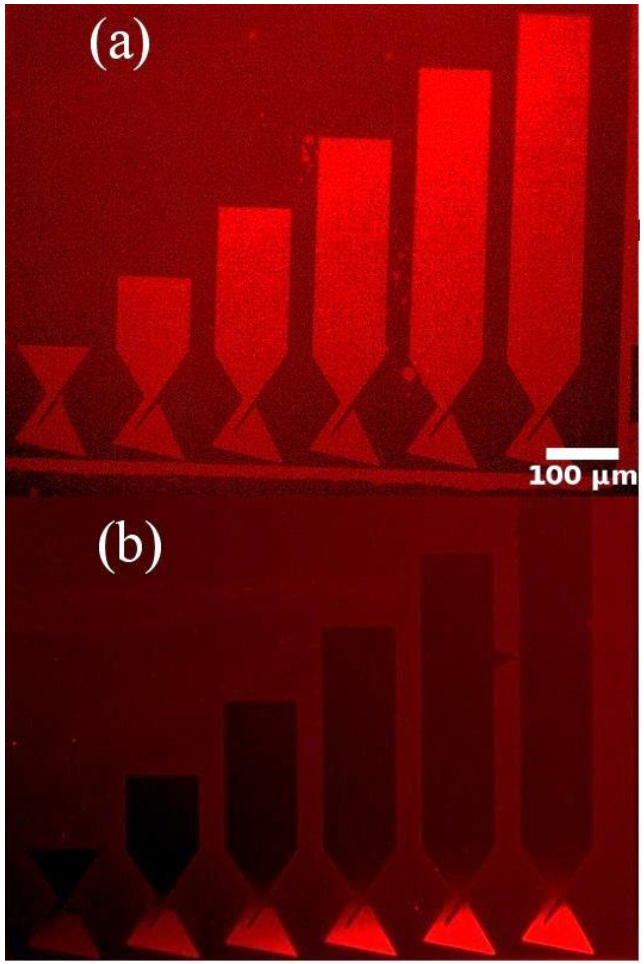
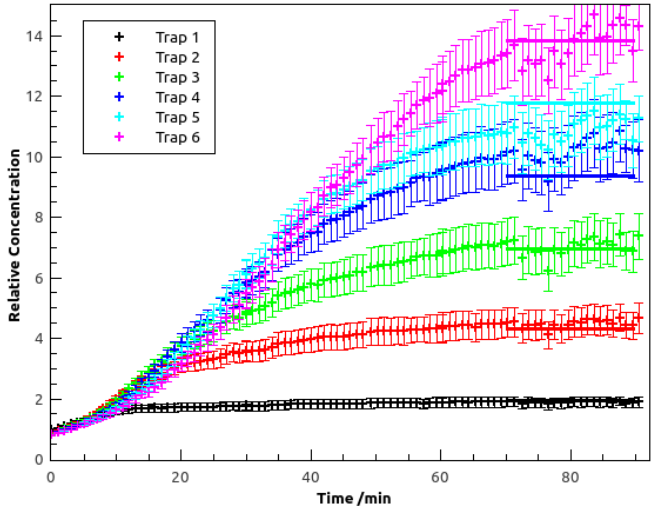
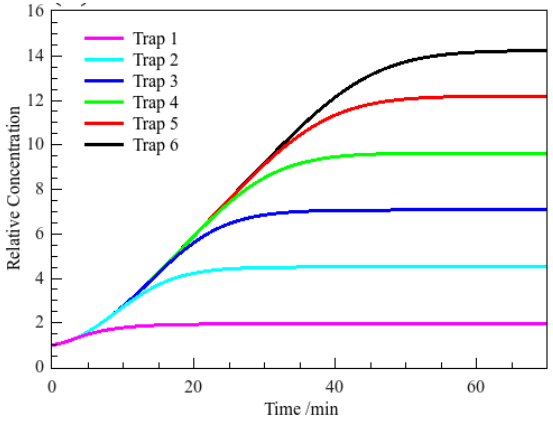




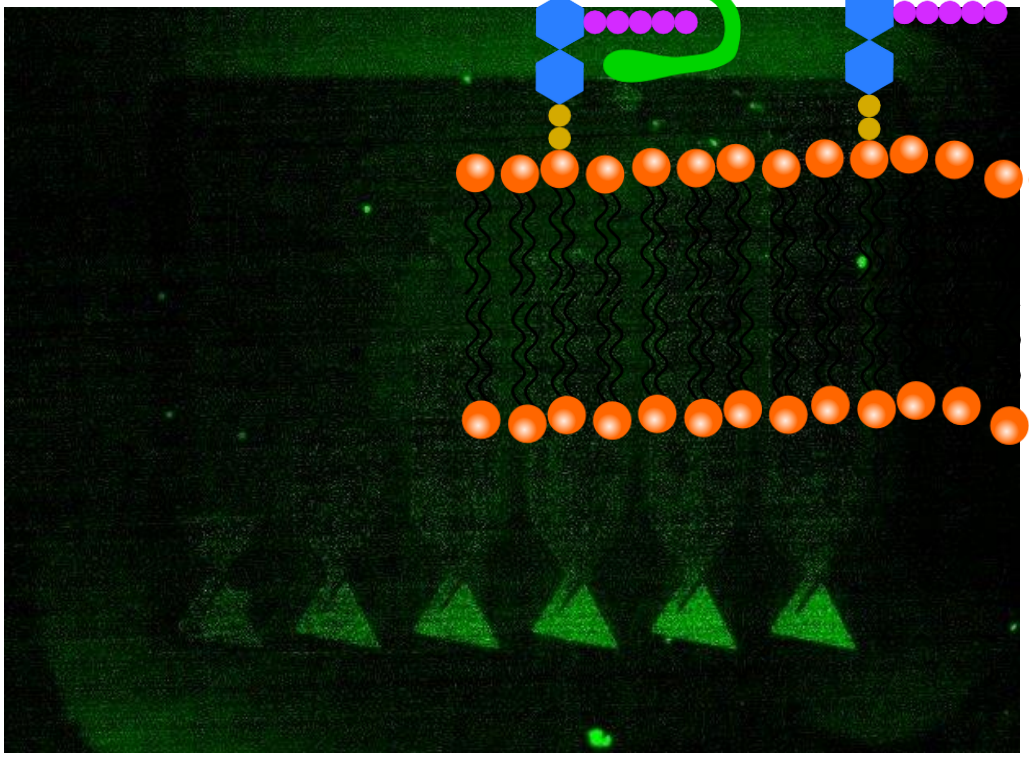
Experiment

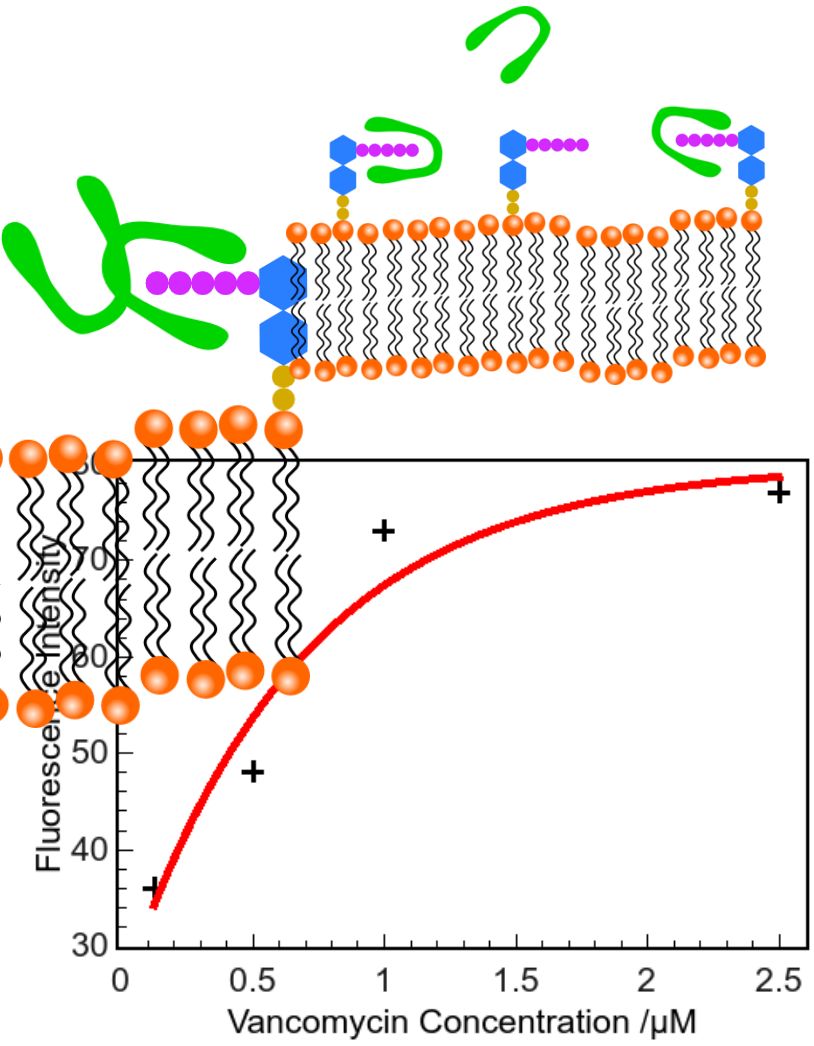


Simulation

Application of Traps:

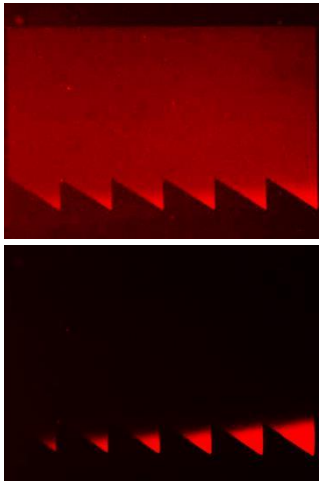
Binding Assays



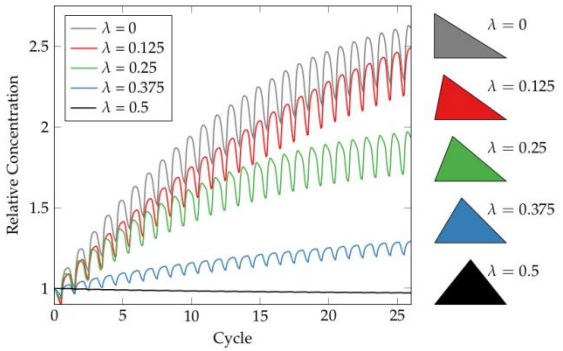


Conclusion

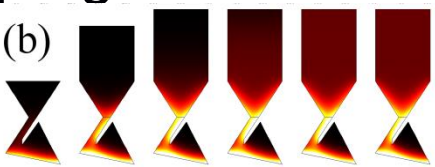
- Realisation of Brownian ratchets in a membrane

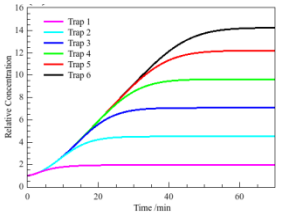


- Optimisation using FEM

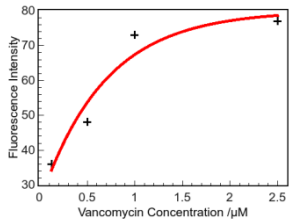


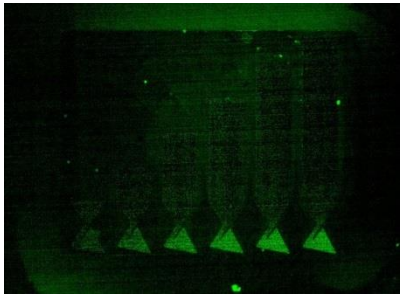
- Pattern design for trapping structures





- Applications in binding assays





Acknowledgments

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(University of Leeds)

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EPSRC
Pioneering research and skills