P.06 Ion channel gating by electrokinetic interactions

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Essential biological processes such as osmoregulation and transmission of nerve impulses crucially depend on translocation of water and ions through nanometre-sized membrane pores. In these processes, the electric fields, hydrodynamic interactions and osmotic gradients are inherently coupled, complicating theoretical analysis. Taking specific interactions between the channel surface and the ions into account, we solve the full set of electrokinetic equations in a geometry based on the crystal structure. We show that the gating kinetics of a simple model channel can be understood entirely in terms of electrostatic and hydrodynamic forces, together with membrane elasticity. The broad applicability of this approach makes it a promising candidate for future physical modelling of a wide range of gated ion channels.