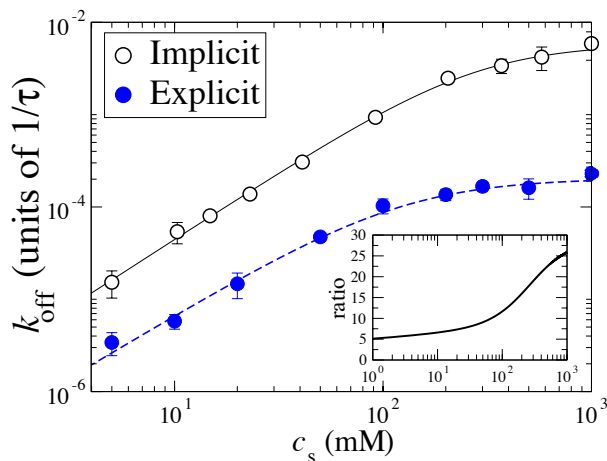
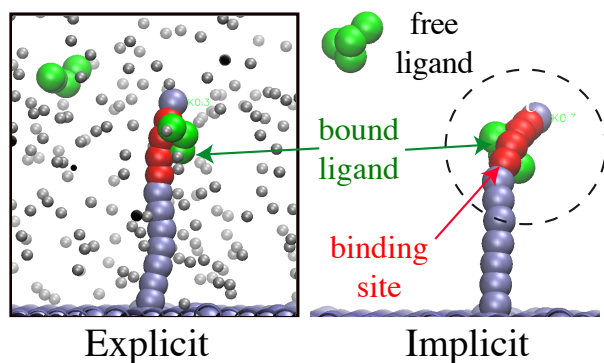


Effects of electrostatic interactions on ligand dissociation kinetics: Implicit vs explicit ions



Schematic description of a binding site used in the implicit and explicit simulations together with calculated unbinding rates (i.e., inverse lifetime) for ligands dissociating from their binding sites as a function of salt concentration

A. Erbas, MO de la Cruz, J. F. Marko, *Phys Rev. E* (2018).

<https://doi.org/10.1103/PhysRevE.97.022405>

Work was performed at Northwestern University

Scientific Achievement

Our MD simulations and data analysis reveal that the implicit Debye-Hückel simulations systematically overestimate the unbinding rates of the ligands, and that this discrepancy is more dramatic near physiological salt conditions as compared to fully treatment of ionic species.

Significance and Impact

Our simulations revealed that a mean-field level treatment of electrostatics overestimates the unbinding rates compared to explicit treatment of ionic species (e.g., by considering their net charge and steric interactions). Thus, implicit models should not be used in the kinetic studies of molecular ligands.

Research Details

- Our results quantitatively support a theoretical model of Facilitated dissociation, in which explicit nature of both ions and ligands play a fundamental role.
- We show at high salt concentration unbinding rates of a ligand from its binding site saturates and become nearly independent of salt
- At high ligand concentrations in solution, salt has a very weak effect on the facilitated dissociation of ligands.



U.S. DEPARTMENT OF
ENERGY

Office of
Science

Northwestern