Abstract Submitted
for the SES06 Meeting of
The American Physical Society

Dynamic model of active transport: application to sodium/potassium pump BRIAN KEATING, ROBERT FINKEL, St. John's University — Active transport is a process where some energetic agent, generally an enzyme powered by ATP, conveys ions across a membrane. Here we present a novel physical approach to modeling the dynamics of active transport. Specifically, we employ a general method whereby the non-equilibrium energetics of active transport derive simply from the chemical kinetic rate equations. The case treated here is an exchange of sodium and potassium ions across a cell membrane at the expenditure of one ATP—a process common to most life forms. The generic rate equations are readily formulated and only two well-established quantities are input, the ATP energy value and the membrane potential. The model uses this sparse information to generate several agreements with experimental values including the relative concentrations of Na and K on either side of the membrane and the celebrated 3:2 transfer ratio of sodium to potassium.

Robert Finkel
St. John's University

Date submitted: 16 Aug 2006 Electronic form version 1.4