Kurt Frey

216 NW 87th St (419) 202-4176
Seattle, WA 98117 kurtfrey at gmail

EXPERIENCE

Institute for Disease Modeling
Global Health Division - Bill and Melinda Gates Foundation Seattle, WA
Senior Research Scientist February 2021 - Present
Research Scientist July 2020 - February 2021
- Estimated burden of congenital rubella syndrome in the Democratic Republic of the Congo under various vaccine introduction scenarios.
- Characterized impact of supplemental immunization activities on spread of SARS-CoV-2.
- Epidemiological modeling and campaign planning for vaccine preventable diseases.

Institute for Disease Modeling
Global Good Fund - Intellectual Ventures Bellevue, WA
Research Scientist October 2016 - July 2020
- Evaluated strategies for measles control in Nigeria using supplemental immunization activities.
- Epidemiological modeling and campaign planning for vaccine preventable diseases.

Argonne National Laboratory Lemont, IL
Engineering Specialist September 2014 - December 2015
Postdoctoral Appointee February 2010 - January 2013
- Implemented mixed potential model for degradation and dissolution of spent fuel waste forms, reducing model execution time by four orders of magnitude.
- Created systems analysis application for analyzing nuclear fuel reprocessing facilities.
- Reformulated steady-state process simulation model for nuclear fuel reprocessing as dynamic tool.
- Developed polarizable force field for molecular dynamics simulation of complex extractants.
- Analyzed production rates of chemical agent precursors using non-export controlled materials.

University of Notre Dame South Bend, IN
Postdoctoral Research Associate February 2013 - January 2015
- Created formation energy expressions using cluster expansions, correlating DFT adsorption energies, in order to estimate material performance related to catalytic converters.
- Implemented Monte Carlo simulations to estimate rates of elementary reactions on metallic surfaces.
- Characterized free energy of adsorbed-state chemical species on late transition metal surfaces, suggesting adsorbate behavior is substantially less restricted than previous believed.

BP Sunbury, United Kingdom
Contractor May 2008 - June 2008
- Analyzed current property estimation accuracy for Exploration and Production Technology.
- Implemented property package developed during doctoral research at MIT to improve performance.
- Simulated reservoir fluid behavior for tertiary oil recovery processes.

Schlumberger Cambridge, MA
Research Scientist June 2006 - December 2006
- Created model to simulate the advection-diffusion of fluid flow through realistic porous networks.
- Applied model to novel three-dimensional lattice representation of Berea sandstone.
- Predicted phenomena observed in NMR flow propagator analysis of sandstone.

Novartis Basel, Switzerland
MIT MSCEP Appointment July 2005 - September 2005
- Created model with interface for pilot plant capacity and efficiency; predicted future bottlenecks.
- Analyzed current implementation of process analytic technology for use in powder pharmaceuticals.
- Formulated novel dry powder mixtures for testing inhalation performance, in-line quality assurance.

Cabot Corporation Billerica, MA
MIT MSCEP Appointment May 2005 - June 2005
- Explained and eliminated undesired phenomena observed during analysis of ink formulations.
- Characterized abilities of novel device to evaluate poly-dispersed colloidal systems.

Ohio State University Columbus, OH
Co-curricular Project Aide January 2000 - December 2002
- Managed applications and interviews for Battelle/Joyce, Maximus scholarship competitions
- Evaluated applications for Honors program admission; administered database for graduation honors.

EDUCATION

Massachusetts Institute of Technology Cambridge, MA
ScD Chemical Engineering, February 2010 September 2005 - January 2010
MS Chemical Engineering Practice, September 2005 September 2004 - September 2005
- Graduate thesis: "Improving Thermodynamic Property Estimation through Volume Translation."
  - Eliminated numerical inconsistencies that led to prediction of aphysical properties.
  - Introduced new formulation of translation function allowing for greater flexibility in modeling.
- Economics minor: Microeconomic theory and natural resource economics.
- Awarded "Outstanding Graduate TA" academic year 2006-2007; Chemical Engineering Dept.

Ohio State University Columbus, OH
BS Chemical Engineering, June 2004 September 1999 - June 2004
- Undergraduate thesis: "Exchange and Correlation Functional Selection in Computational Chemistry of Actinide Containing Compounds."
  - Benchmarked basis set accuracy for relativistic core small molecules containing actinides.
  - Evaluated implementation of density functional algorithms in Gaussian for actinide systems.
- Computer science minor: Software and algorithms.
- “Award for Academic Excellence”; Chemical Engineering Dept., Senior / Sophomore.
- "Outstanding Mathematics Student"; Math Dept., Sophomore.

PUBLICATIONS / PRESENTATIONS

Refereed Papers
- K Frey, B Hagedorn, K A McCarthy, R Hutubessy, S A Wang, “Modeling antifipated changes in numbers of SARS-CoV-2 infections within communities due to immunization campaigns,” *Gates Open Res.*, **2022,** 6, 7.
- A Cheng, K Frey, G N Mwamba, K A McCarthy, N A Hoff, A W Rimoin, “Examination of scenarios introducing rubella vaccine in the Democratic Republic of the Congo,” *Vaccine: X*, **2021**, 9, 100127.
- A Bajpai, K Frey, W Schneider, “Comparison of Coverage-Dependent Binding Energy Models for Mean-Field Microkinetic Rate Predictions,” *Langmuir*, **2020**, 36, 465-474.
- M Zimmerman, et al., “Optimization of frequency and targeting of measles supplemental immunization activities in Nigeria: a cost-effectiveness analysis,” *Vaccine*, **2019**, 37, 6029-6047.
- A Bershteyn, et al., “Implementation and applications of EMOD, and individual-based multi-disease modeling platform,” *Pathog. Dis.*, **2018**, 76, fty059.
- A Bajpai, P Mehta, K Frey, A Lehmer, W Schneider, “Benchmark First-Principles Calculations of Adsorbate Free Energies,” *ACS Catal.*, **2018**, 8, 1945-1954.
- A Bajpai, K Frey, W F Schneider, “A Binary Approach to Ternary Cluster Expansions: The NO-O-Vacancy System on Pt(111),” *J. Phys. Chem. C*, **2017**, 121, 7344-7354.
- J Jerden Jr, K Frey, W Ebert, “A multiphase interfacial model for the dissolution of spent nuclear fuel,” *J. Nucl. Mat.*, **2015**, 462, 135-146.
- K Frey, D Schmidt, C Wolverton, W Schneider, “Implications of coverage-dependent O adsorption for catalytic NO oxidation on the late transition metals,” *Cat Sci. Tech.*, **2014**, 4, 4356-4365.

- S Paap, K Frey, G Johnson, J Tester, “Solubility of benzyl methacrylate/methacrylic acid copolymers in carbon dioxide-expanded acetone and correlation with the PC-SAFT Equation of State,” *Fluid Phase Equilib* **2014**, 375, 115-123.
- K Frey, J Tester, M Modell, "Density-and-temperature-dependent volume translation for the SRK EOS: 2. Mixtures," *Fluid Phase Equilib.*, **2013**, 343, 13-23.
- K Frey, J Krebs, C Pereira, "Time Dependent Implementation of Argonne’s Models for Universal Solvent Extraction," *Ind. Eng. Chem. Res.*, **2012**, 51, 13219-13226.
- K Frey, J Tester, M Modell, "Density-and-temperature-dependent volume translation for the SRK EOS: 1. Pure fluids," *Fluid Phase Equilib.*, **2009**, 279, 56-63.
- K Frey, C Augustine, R P Ciccolini, S Paap, M Model, J Tester, "Volume translation in equations of state as a means of accurate property estimation," *Fluid Phase Equilib.*, **2007**, 260, 316-325.
- G Picard, K Frey, "Method for modeling transport of particles in realistic porous networks: Application to the computation of NMR flow propagators," *Phys. Rev. E.*, **2007**, 75, 066311.

Talks and Presentations

- “Rubella vaccine introduction is unlikely to increase CRS burden,” MIDAS Annual Meeting, Atlanta, GA; October 2023.
- “Measles genotyping and insights from modeling neutral co-circulation in the Democratic Republic of the Congo,” Ecology and Evolution of Infectious Diseases, State College, PA; May 2023.
- “Simulating Improved Surveillance to Reduce Measles Transmission in Ghana,” MIDAS Annual Meeting, Bethesda, MD; September 2022.
- “Examination of scenarios introducing rubella vaccine in the Democratic Republic of the Congo,” Ecology and Evolution of Infectious Diseases, Atlanta, GA; May 2022.
- “Transmission of circulating vaccine derived poliovirus type 2 in Nigeria post-cessation of routine immunization,” Epidemics 8, Virtual; December 2021.
- “Spatial resolution in agent-based metapopulation models of transmission,” MIDAS Annual Meeting, Virtual; April 2021.
- “Developing intervention strategies for measles control and elimination in an environment of persistent importation,” Epidemics 7, Charleston, SC; December 2019.
- “Maintaining Elimination in an Environment of Persistent Importation,” IDM Annual Disease Modeling Symposium, Bellevue, WA; April 2019.
- “The Role of Supplementary Immunization Activity Scheduling on Measles Incidence in Nigeria,” IDM Annual Disease Modeling Symposium, Bellevue, WA; April 2017.
- “Calculating the free energy of atomic oxygen adsorbed on late transition metal surfaces,” ACS National Meeting & Exposition, San Francisco, CA; April 2017.
- “Estimating Reaction Rates from Coverage Dependent Binding Energies,” AIChE Annual Meeting, Atlanta, GA; November 2014
- “Multi-domain mixed potential model for spent fuel dissolution,” AIChE Annual Meeting, Minneapolis, MN; October 2012.
- “Gibbs ensemble Monte Carlo examination of the water/n-dodecane/tributyl phosphate system,” ACS National Meeting & Exposition, San Diego, CA; March 2011.
- “Time dependent implementation of Argonne’s Model for Universal Solvent Extraction,” AIChE Annual Meeting, Minneapolis, MN; October 2011.
- “Time dependent implementation of Argonne’s Model for Universal Solvent Extraction,” Argonne Postdoctoral Research Symposium, Argonne, IL; September 2011.
- “Polarizable force field development and application for simulations of interest to solvent extraction,” ACS National Meeting & Exposition, Anaheim, CA; March 2011.
- “Multiparameter equation of state basis set selection,” AIChE Annual Meeting, Salt Lake City, UT; November 2010.
- “Development of a polarizable force field for tributyl phosphate,” Argonne Postdoctoral Research Symposium, Argonne, IL; September 2010.
- “Volume translated equation of state for supercritical fluid mixture densities,” ACS National Meeting & Exposition, San Francisco, CA; March 2010.
- "Method of volume translation," ACS Green Chemistry Summer School, Golden, CO; July 2008.
- "Opportunities in energy efficiency from process simulation," MIT Energy Showcase, Cambridge, MA; April 2008.

- "Improved thermodynamic property estimation through the application of volume translation," BP Projects Academy Showcase, Cambridge, MA; October 2007.
- "Accuracy in thermophysical property estimation," National Renewable Energy Laboratory, Golden, CO; January 2006.

ACTIVITIES

Professional Development

- Pathogen Evolution, Selection, and Immunity; UW SISMID; Seattle, WA; July 2017.
- Wind Energy Systems Engineering Workshop; NREL NWTC; Broomfield, CO; January 2013.
- Annual Short Course on Parallel Programming; ParLab UC Berkeley; Berkeley, CA; August 2012.
- Optimization Modeling and Integrated Process Operations; CAPD CMU; Pittsburgh, PA; May 2012.
- Postdoc-to-Faculty Workshop; ACS Education Division; Boston, MA; August 2010.
- Advanced Course on Molecular Simulation of Complex Chemical Systems; DTU CERE; Lyngby, Denmark; July 2010.
- Advanced Course on Thermodynamic Models: Fundamentals & Computational Aspects; DTU CERE; Lyngby, Denmark; January 2009.
- Green Chemistry and Sustainable Energy Summer School; ACS Green Chemistry Institute; Golden, CO; July 2008.
- MIT Sci/Tech Policy Bootcamp; MIT Dept. of Political Science; January 2008

Language Proficiencies

- C / C++; Python; Fortran; Matlab; MPICH; OpenMP

Service

- Treasurer; Bellevue Community Band; Bellevue, WA; 2018 – Present.
- Project Leader; Rebuilding Together Seattle; Seattle, WA; April 2019, April 2018, April 2017.
- Skyway Conference STEM Contest Judge; Illinois Skyway Conference; Palos Hills, IL; April 2012.
- Middle School Regional Science Bowl Judge; US Department of Energy; Argonne, IL; February 2012, February 2011.
- Middle School Regional Science Fair Judge; Chicago Public Schools; Chicago, IL; January 2012.
- Hispanic Educational Outreach Volunteer; Argonne National Laboratory; Argonne, IL; October 2011, October 2010.
- SERCh Poster Competition Judge; US Department of Energy; Argonne, IL; November 2010.
- AAAS Congressional Visits Day; MIT Science Policy Initiative; Washington, DC; March 2008.
- State Science Day Judge; Ohio Academy of Science; Columbus, OH; May 2004, May 2003.
- Wonders of Our World Volunteer; Ohio State Chemistry Department; Columbus, OH; Spring 2003.

Personal Interest

- Instrumentalist (Tenor Trombone; Bass Trombone; Euphonium; Tuba): Bellevue Community Band, Issaquah Philharmonic Orchestra, Sno Valley Winds, Redmond Academy of Theater, South Bend Civic Theatre, Notre Dame Theatre, Notre Dame University Band, Cambridge Symphony Orchestra, MIT Musical Theater Guild, MIT Gilbert and Sullivan Players, MIT Concert Band, Somerville Brass Quintet, Summer Street Brass Quintet, OSU University Band, OSU Athletic Band, OSU Repertory Band, OSU Marching Band.
- Community volunteer: Rebuilding Together Seattle, Lakeview Pantry, National Braille Press, Perkins School for the Blind, Columbus Recreation and Parks Department.
- Voice talent (Narrow IPA; Standard American; Proper American): Narrations, Voice-over, ADR.
- Club Sports (Ice hockey; Football; Basketball; Softball; Volleyball; Bowling, Curling): Notre Dame Intramural Athletics, Argonne Club, MIT Intramural Athletics, Ohio State Intramural Athletics