



ALEXIS HOERTER

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WORK EXPERIENCE

Postdoctoral Research Assistant | Weldon School of Biomedical Engineering, Purdue University | West Lafayette, IN (remote) | June 2024 to June 2025

- Repurposed a physiologically based pharmacokinetic model of tuberculosis drug distribution using MATLAB to understand how drug delivery routes (oral vs inhaled) alter bacterial burden in the human lung to explore alternative treatment strategies for the tuberculosis granuloma.
- Trained and managed junior graduate students in HPC usage, lab coding management practices, calibration techniques, and presentation skills.

Predoctoral Fellow & Graduate Student Research Assistant | Weldon School of Biomedical Engineering, Purdue University | West Lafayette, IN | May 2019 to May 2024

- Developed an *in silico*, agent-based mechanistic model (ABM) of virtual cells at the cellular level to (1) understand the role of host immune status during *in vitro* Mycobacterium tuberculosis (Mtb) infection, (2) predict the impact of T cell exhaustion on HIV infection using perinatal participant data, and (3) quantify synergistic pathogen expansion during Mtb-HIV coinfection.
- Analyzed emergent behavior in ABM that recapitulates *in vitro* experimental results from Guirado et al. 2015 and Texas Biomedical Research Institute (Texas Biomed) of bacterial growth, HIV load, macrophage phagocytosis, granuloma formulation, immune cell activation, and T cell proliferation over time, demonstrating the *in silico* model's ability to reproduce and predict *in vitro* biology.
- Utilized Latin Hypercube Sampling for parameter estimation, calibrated models to reflect experimental data, and deployed simulations for high-performance computing (HPC).
- Experienced in statistical methods for data interpretation, including the A-measure for stochastic superiority as well as uncertainty and sensitivity analysis using Partial Rank Correlation Coefficients.
- Executed code management practices and version control measures using GitHub.
- Secured the *Indiana Clinical and Translational Sciences Institute TL1 Predoctoral Training Fellowship* to fully finance the last two years of my doctoral studies.
- Accelerated analysis tools from 12 hours to less than a minute in MATLAB for calcium wave propagation during plant immune signaling.

Research Assistant | Astellas Pharma US – Pharmacokinetics, Modeling, & Simulation | Northbrook, IL | May 2022 to August 2022

- Performed exploratory research applying stochastic differential equations (SDEs) to physiologically based pharmacokinetic models to generate virtual patient populations using SimBiology and MATLAB
- Determined that SDEs did not perform better than using random parameter distributions in ordinary differential equation (ODE) models to account for patient variability in real world clinical data

Researcher | ReGel Technologies & Rowan University Glassboro, NJ | September 2017 to May 2018

- Designed a mechanical injection device for hydrogel-based degenerative disc replacement treatment.

Researcher | Rowan University - Tissue Engineering & Biomaterials Laboratory | Glassboro, NJ | September 2016 to May 2017

- Supported *in vitro* temperature-controlled characterization of a chemotherapy drug delivery system.

SKILLS

Programming Languages and Software: Java, MATLAB, GitHub/GIT, Python, Repast Simphony, Microsoft Office, SLURM, HTCondor, Bash, CompuCell3D, SimBiology, STATA, Polymath, Visual Basic

Computational and Statistical Methods: Agent-Based Modeling, Virtual Cell Modeling, *In Silico* simulation, Object-Oriented Programming, High-Performance Computing, Uncertainty Analysis, Sensitivity Analysis, Latin Hypercube Sampling, Parameter Estimation, Model Calibration, Model Validation, Data Analysis, Data Visualization, Partial Rank Coefficient Correlation, Physiologically Based Pharmacokinetic Modeling (PBPK), Ordinary Differential Equation (ODE) modeling, Stochastic Differential Equation modeling (SDE), Mechanistic Modeling, Biostatistics

EDUCATION & ACADEMIC AWARDS

Ph.D. in Biomedical Engineering | Purdue University, Weldon School of Biomedical Engineering | West Lafayette, IN | 2019 to 2024

Awards: *Indiana Clinical and Translational Sciences Institute TL1 Predoctoral Training Fellow (2022-2024), Purdue University Bravo+ Enhanced Employee Recognition Award (2024), 4 national/international travel awards, Mark and Pamela Lamp Graduate Scholarship (2019).*

Leadership: *Biomedical Engineering Graduate Student Association: Professional Development Co-chair (2021-2022), Outreach Co-chair (2020-2021)*

Conferences: *Presented posters and talks at 7 national and 1 international conferences.*

Bachelor's of Science in Chemical Engineering w/ Biological Engineering Specialization | Rowan University | Glassboro, NJ | 2014 to 2018

PUBLICATIONS

Hoerter A, Petrucciani A, Khaitan A, Pienaar E. (2025) Partially-functional exhausted CD8+ T cells can contribute to short-term viral suppression: a computational prediction for children with perinatal HIV. <https://doi.org/10.1101/2025.09.18.677001>

Hoerter A, Petrucciani A, Bonifacio J, Arnett E, Schlesinger LS, Pienaar E. (2025) Timing matters in Macrophage/CD4+ Tcell interactions: An agent-based model comparing Mtb host-pathogen interactions between latently infected and Mtb-naïve individuals. *mSystems* 10:e01290-24. <https://doi.org/10.1128/msystems.01290-24>

Hoerter A, Arnett E, Schlesinger LS and Pienaar E (2022) Systems biology approaches to investigate the role of granulomas in TB-HIV coinfection. *Front. Immunol.* 13:1014515. <https://doi.org/10.3389/fimmu.2022.1014515>

Zhang W, Kumar N, Helwig JR, **Hoerter A**, Iyer-Pascuzzi AS, Umulis DM, Pienaar E, Staiger CJ. (2025) Local traveling waves of cytosolic calcium elicited by defense signals or wounding are propagated by distinct mechanisms in *Arabidopsis*. *Science Signaling*. <https://doi.org/10.1101/2025.01.23.634554>

Petrucciani A, **Hoerter A**, Kotze L, Du Plessis N, and Pienaar E (2024) Agent-based model predicts that layered structure and 3D movement work synergistically to reduce bacterial load in 3D in vitro models of tuberculosis granuloma. *PLoS Comput Biol* 20(7): e1012266. <https://doi.org/10.1371/journal.pcbi.1012266>

Petrucciani A, **Hoerter A**, Kotze L, Du Plessis N, and Pienaar E (2024). In silico agent-based modeling approach to characterize multiple in vitro tuberculosis infection models. *PLoS ONE* 19(3): e0299107. <https://doi.org/10.1371/journal.pone.0299107>