Monica E. Shapiro

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Department of Chemical & Petroleum Engineering, University of Pittsburgh, 940 Benedum Hall, Pittsburgh, PA 15213

Research Interests

Dynamical systems modeling, parameter optimization, numerical methods, forecasting, uncertainty.

Education

University of Pittsburgh **Pittsburgh, PA**
Ph.D. in Chemical Engineering, GPA – 3.88 *2017 – 2022 (Expected)*
Thesis Advisors: Robert S. Parker, Ph.D. and Timothy E. Corcoran, Ph.D.

Lehigh University **Bethlehem, PA**
B.S. in Chemical Engineering, GPA – 3.48 *2013 – 2017*

Research Positions

University of Pittsburgh

Graduate Student Researcher *2017 – Present*
Thesis Title: "Towards Personalized Medicine in Cystic Fibrosis: Patient-Specific Modeling of Mucociliary Clearance and Airway Surface Liquid Absorption"
Advisors: Robert Parker and Timothy Corcoran

Built open-source profile likelihood estimator package in Python (`plepy`). Mentored an NSF REU summer intern on a profile likelihood project. Developed physiologically-based dynamic model of mucus clearance through airways and airway surface liquid absorption that captures localized differences between subjects. Current work aims to link this organ-scale model with an existing tissue-scale model.

REU Intern *Summer 2016*
Advisors: Robert Parker and Timothy Knab

Designed graphical user interface for pharmacokinetic/pharmacodynamic model of IV chemotherapy treatment for solid tumors. Modified dynamic models to adapt drug sensitivity parameters based on real-time clinical data.

Lehigh University

Undergraduate Researcher *Fall 2016*
Advisor: Jeetain Mittal

Ran molecular dynamics simulations of coarse-grained model using LAMMPS. Computed binding energies of single-stranded DNA adsorption on carbon nanotubes.

Publications

1. Serrano Castillo, F., ..., **Shapiro, M. E.**, et al. "A physiologically-motivated model of cystic fibrosis liquid and solute transport dynamics across primary human nasal epithelia." *Journal of Pharmacokinetics and Pharmacodynamics* (2019).
2. **Shapiro, M. E.**, Corcoran, T. E., Bertrand, C. A., Serrano Castillo, F. & Parker, R. S. "Physiologically-Based Model of Fluid Absorption and Mucociliary Clearance in Cystic Fibrosis." *IFAC PapersOnLine* **51**, 102–103 (2018).
3. Serrano Castillo, F., Bertrand, C. A., Corcoran, T. E., **Shapiro, M. E.** & Parker, R. S. "A Dynamic Model of Cystic Fibrosis Airway Epithelium Electrophysiology." *IFAC PapersOnLine* **51**, 94–97 (2018).

Awards and Honors

Outstanding Teaching Assistant Award — **University of Pittsburgh**
Awarded by the Engineering Graduate Student Organization. — *2021*

Research Experience for Undergraduates (REU) — **National Science Foundation**
Host Institution: University of Pittsburgh — *2016*

Elisha P. Wilbur Mathematics Prize — **Lehigh University**
Awarded to the highest ranking freshman engineers in mathematics. — *2014*

Conference Presentations

1. Shapiro, M. E., Corcoran, T. E., Bertrand, C. A. & Parker, R. S. "Up, Up, and Away: A Physiologically-Motivated Dynamic Model of the Lung's Mucociliary Clearance Escalator." Oral presentation at *American Institute of Chemical Engineers (AIChE) Annual Meeting*, **Boston, MA**, 2021.
2. Shapiro, M. E., Parker, R. S., Bertrand, C. A., Serrano Castillo, F. & Corcoran, T. E. "Mathematical Model of Mucociliary Clearance and Airway Surface Liquid Absorption Dynamics." Poster presentation at *North American Cystic Fibrosis Conference (NACFC)*, **Nashville, TN**, 2019.
3. Shapiro, M. E., Corcoran, T. E., Bertrand, C. A., Serrano Castillo, F. & Parker, R. S. "Physiologically-Based Model of Fluid Absorption and Mucociliary Clearance in Cystic Fibrosis." Poster presentation at *Foundations of Systems Biology in Engineering (FOSBE)*, **Chicago, IL**, 2018.

Teaching

Engineering a Craft Brewery (ENGR 1933) — **University of Pittsburgh**
Grader — *Spring 2018 – 2022*
Graded final exam, homeworks, and sensory perception quizzes.

Reactive Process Engineering (CHE 0400) — **University of Pittsburgh**
Teaching Assistant — *Spring 2021*
Taught weekly virtual recitations, held office hours, made solution guides, and graded. Designed introductory MATLAB recitation. Won **Outstanding TA Award** for my role in this course.

Systems Engineering I: Dynamics and Modeling (CHE 0500) — **University of Pittsburgh**
Teaching Assistant — *Fall 2019, Fall 2018*
Taught weekly recitations using Simulink/MATLAB, held office hours, and graded.

Methods of Analysis in Chemical Engineering (CHE 201) — **Lehigh University**
Apprentice Teacher — *Fall 2016*
Assisted with weekly computational labs focused on numerical integration and solvers in MATLAB and Excel. Led lab when instructor was absent. Held weekly office hours and graded.

Leadership Roles

- Graduate Women in Engineering Network – President (2020 – 2022), Treasurer (2019 – 2020)
- Ingenium – Editorial Board (2019 – 2022)
- Chemical Engineering Graduate Safety Committee – Lab Representative (2018 – 2020)
- Chemical Engineering Graduate Student Association – Recruitment Chair (2018 – 2019)

Skills

Computer Skills: Python, MATLAB/Simulink, R, Blender, HTML5/CSS, Aspen Plus/Dynamics
Languages: Native - English; Familiar - French
Relevant Coursework: Bayesian Signal Processing, Optimal Control, Statistical & Computational Methods for Systems Biology, Fundamentals of Reactive Processes, Data Inference & Applied Machine Learning, Advanced Scientific Visual Communication, Molecular Modeling and Simulation