Evan Spotte-Smith

(they/them)

Assistant Prof. of Chemical Engineering

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Education

2023 **Doctor of Philosophy (Ph.D.)**, University of California — Berkeley (UC Berkeley),

Program: Materials Science and Engineering

Advisor: Prof. Kristin A. Persson

Thesis: "On the Exploration of Electrochemical Reaction Cascades"

2021 Master of Science (M.S.), UC Berkeley,

Program: Materials Science and Engineering

2019 Bachelor of Science (B.S.), Columbia University,

Program: Materials Science and Engineering

Minor: Sustainable Engineering

Research Experience

2025 - (Incoming) Assistant Professor of Chemical Engineering, Carnegie Mellon University (CMU),

Start Date: August 1, 2025

2024 - 2025 Carnegie Bosch Institute Fellow, CMU,

Advisor: Prof. Rachel C. Kurchin

2024 Carnegie Bosch Institute Fellow, CMU,

Advisor: Prof. Gabriel dos Passos Gomes

2019 - 2023 Graduate Student Researcher, Lawrence Berkeley National Laboratory (LBNL),

Advisor: Prof. Kristin A. Persson

2023 Cell Modeling Intern, Tesla Motors

2018 - 2019 Undergraduate Student Researcher, LBNL,

Advisor: Dr. Anubhav Jain, Dr. Ravi Prasher

2016 - 2019 Lead Undergraduate Researcher, Columbia University,

Advisor: Prof. Irving P. Herman

Teaching Experience

Fall 2025 Instructor, CMU, Numerical Methods and ML for Chemical Engineers

Fall 2024 Guest Lecturer, CMU, "Data Science in the Chemical Sciences"

Spring 2022 **Graduate Student Instructor**, *UC Berkeley*, General Chemistry & Quantitative Analysis

Evaluation: median 7.0/7.0; mean 6.5/7.0

2020 Instructor, Materials Project Workshop, "Pymatgen Foundations"

Fall 2018 **Teaching Assistant**, *Columbia University*, Thermodynamics, Kinetic Theory, and Statistical Mechanics

Mentoring

2025 - Punna Amornvivat,

Project: Methods for machine learning on chemical reaction network hypergraphs

2024 - Andrew Timmins,

Project: Accelerated simulations of solid-state nucleation and phase transformations

2025 Vanshika Singh,

Project: Simulations of electrode protection in metal-mediated ammonia synthesis

2024 - 2025 Shreya Pagaria,

Project: Unsupervised phase identification from molecular dynamics simulations

2022 - 2023 Laura Zichi,

Project: Developing tools to simulate reactivity at dynamic fluid-solid interfaces

2021 - 2022 **Thea Bee Petrocelli**,

Project: First-principles explanations of electrolyte reactivity in Li-ion batteries

2021 - 2022 Nikita Redkar,

Project: Learning electrochemical reaction products using natural language processing

2020 - 2022 **Aniruddh Khanwale**,

Project: Calculation of charge transfer rates through battery interphases

2020 - 2022 Ronald Kam,

Project: Kinetic modeling of Li-ion battery solid-electrolyte interphase formation

Resources & Funding

2024 - 2026 Synthesis Advanced Research Challenge, Toyota Research Institute,

Project: Direct Introduction of Competition and Kinetics to Materials Mechanism and

Reaction Network Prediction

Award type: Funding

Role: PI

Total award amount: \$500,000

2025 - 2026 National Artificial Intelligence Research Resource (NAIRR) Pilot,

Project: Leveraging Machine Learned Interatomic Potentials to Predict Materials Syn-

thesis Routes

Award type: High-performance computing allocation

Role: PI

Total award amount: 17,500 GPU-hours; 380,000 CPU-hours

2024 - 2025 Advanced Cyberinfrastructure Coordination Ecosystem: Services & Support (AC-

CESS), National Science Foundation,

Project: Rational Design of Electrolytes for Ammonia Synthesis Using Machine-Learned

Potentials

Award type: High-performance computing allocation

Role: PI

Total award amount: 750,000 ACCESS credits

2020 - 2024 Schrödinger, Inc.,

Award type: Partnership

Role: Initiated partnership, lead point of contact

Total award amount: In kind, valued at \$5,517,000

2021 – 2024 High-Performance Computing, National Renewable Energy Laboratory,

Project: Integrated Modeling and Machine Learning of Solid-Electrolyte Interface

Reactions of the Si Anode

Award type: High-performance computing allocation

Role: Contributor

Total award amount: 6,884,000 node-hours

2020 - 2023 Energy Research Computing Allocations Process, National Energy Research Super-

computing Center,

Award type: High-performance computing allocation

Role: Contributor

Total award amount: 325,000 node-hours

Honors & Awards

- 2025 Outstanding Reviewer, Institute of Physics
- 2024 Carnegie Bosch Institute Fellowship, CMU
- 2024 President's Postdoctoral Fellowship, CMU (declined)
- 2024 **Pre-Faculty Workshop**, NextProf Nexus
- 2023 1st Prize, Winton-Kavli Research Pitch Competition
- 2023 1st Prize, Innovation Expo, Berkeley Energy & Resource Collaborative Energy Summit
- 2023 Battery Student Slam Winner, 241st Electrochemical Society Meeting
- 2022 Philomathia Graduate Student Fellowship, Kavli Energy NanoScience Institute
- 2020 Honorable Mention, NSF Graduate Research Fellowship Program
- 2019 Honorable Mention, NSF Graduate Research Fellowship Program
- 2019 Frank McQuiston Fellowship, UC Berkeley Department of Materials Science & Engineering
- 2019 Clarendon Fund Scholarship, University of Oxford (declined)
- 2019 Magna Cum Laude, Columbia University
- 2019 Tau Beta Pi New York Alpha Chapter
- 2019 Francis B. F. Rhodes Prize, Columbia University
- 2019 **King's Crown Leadership Excellence Award for Civic Responsibility**, Columbia University

Peer-Reviewed Publications

- (1) Horton, M. K.; Huck, P.; Yang, R. X.; Munro, J. M.; Dwaraknath, S.; Ganose, A. M.; Kingsbury, R. S.; Wen, M.; Shen, J.-X.; Mathis, T. S.; Kaplan, A. D.; Berket, K.; Riebesell, J.; George, J.; Rosen, A. S.; Spotte-Smith, E. W. C.; McDermott, M. J.; Cohen, O. A.; Dunn, A.; Kuner, M.; Rignanese, G.-M.; Hautier, G.; Petretto, G.; Waroquiers, D.; Griffin, S. M.; Neaton, J. B.; Chrzan, D. C.; Asta, M.; Cholia, S.; Ceder, G.; Ong, S. P.; Jain, A.; Persson, K. A. Accelerated Data-Driven Materials Science with the Materials Project. *Nature Materials (in press)* **2025**
- (2) Guha*, R. D.; Vargas*, S.; Spotte-Smith, E. W. C.; Epstein, A. R.; Venetos, M.; Kingsbury, R.; Wen, M.; Blau, S. M.; Persson, K. A. HEPOM: Using Graph Neural Networks for the Accelerated Predictions of Hydrolysis Free Energies in Different pH Conditions. *Journal of Chemical Information and Modeling* **2025**
- (3) Zichi*, L.; Barter*, D.; Sivonxay*, E.; Spotte-Smith, E. W. C.; Srinivaas, M. R.; ; Chan, E.; Persson, K. A.; Blau, S. M. RNMC: Kinetic Monte Carlo Implementations for Complex Reaction Networks. *The Journal of Open Source Software* **2024**, *9* (104), 7244
- (4) Soto, M.; Fink, K.; Zweifel, C.; Weddle, P. J.; Spotte-Smith, E. W. C.; Veith, G.; Persson, K. A.; Colclasure, A. M.; Villers, B. J. Tremolet de. Solubilities of Ethylene and Carbon Dioxide Gases in Lithium-Ion Battery Electrolyte. *Journal of Chemical & Engineering Data* **2024**, 69 (6), 2236–2243
- (5) Leon, N. J.; Illic, S.; Xie, X.; Jeong, H.; Yang, Z.; Wang, B.; Spotte-Smith, E. W. C.; Stern, C.; Hahn, N.; Zavadil, K.; Cheng, L.; Persson, K.; Connell, J.; Liao, C. Design Principles and Routes for Calcium Alkoxyaluminate Electrolytes. *The Journal of Physical Chemistry Letters* **2024**, *15* (19), 5096–5102
- (6) Vijay, S.; Venetos, M.; Spotte-Smith, E. W. C.; Kaplan, A.; Wen, M.; Persson, K. A. CoeffNet: Predicting Activation Barriers Through a Constrained, Equivariant and Chemically-Interpretable Graph Neural Network. *Chemical Science* **2024**, *15* (8), 2923–2936
- (7) Spotte-Smith*, E. W. C.; Vijay*, S.; Petrocelli, T. B.; Rinkel, B. L. D.; McCloskey, B. D.; Persson, K. A. A Critical Analysis of Chemical and Electrochemical Oxidation Mecha-

- nisms in Li-Ion Batteries. The Journal of Physical Chemistry Letters **2024**, 15 (2), 391–400
- (8) Guha*, R. D.; Vargas*, S.; Spotte-Smith, E. W. C.; Epstein, A. R.; Venetos, M.; Wen, M.; Kingsbury, R.; Blau, S. M.; Persson, K. A. HEPOM: A Predictive Framework for Accelerated Hydrolysis Energy Predictions of Organic Molecules. *NeurIPS AI4Mat* **2023**
- (9) Spotte-Smith, E. W. C.; Cohen, O. A.; Blau, S. M.; Munro, J. M.; Yang, R.; Guha, R. D.; Patel, H. D.; Vijay, S.; Huck, P.; Kingsbury, R.; Horton, M. K.; Persson, K. A. A Database of Molecular Properties Integrated in the Materials Project. *Digital Discovery* **2023**, *2* (6), 1862–1882
- (10) Weddle, P. J.; Spotte-Smith, E. W. C.; Verma, A.; Patel, H. D.; Fink, K.; Villers, B. J. Tremolet de; Schulze, M. C.; Blau, S. M.; Smith, K. A.; Persson, K. A.; Colclasure, A. M. Continuum-Level Modeling of Li-Ion Battery SEI by Upscaling Atomistically Informed Reaction Mechanisms. *Electrochimica Acta* **2023**, *468* (143121)
- (11) Spotte-Smith, E. W. C.; Blau, S. M.; Barter, D.; Leon, N. J.; Hahn, N. T.; Redkar, N. S.; Zavadil, K. R.; Liao, C.; Persson, K. A. Chemical Reaction Networks Explain Gas Evolution Mechanisms in Mg-Ion Batteries. *Journal of the American Chemical Society* **2023**, *145* (22), 12181–12192
- (12) Spotte-Smith*, E. W. C.; Epstein*, A. R.; Venetos, M.; Andriuc, O.; Persson, K. A. Assessing the Accuracy of Density Functional Approximations for Predicting Hydrolysis Reaction Kinetics. *Journal of Chemical Theory and Computation* **2023**, *19* (11), 3159–3171
- (13) Wen, M.; Spotte-Smith, E. W. C.; Blau, S. M.; McDermott, M. J.; Krishnapriyan, A.; Persson, K. A. Chemical Reaction Networks and Opportunities for Machine Learning. *Nature Computational Science* **2023**, *3*, 12–24
- (14) Spotte-Smith*, E. W. C.; Petrocelli*, T. B.; Patel, H. D.; Blau, S. M.; Persson, K. A. Elementary Decomposition Mechanisms of Lithium Hexafluorophosphate in Battery Electrolytes and Interphases. *ACS Energy Letters* **2023**, *8* (1), 347–355
- (15) Spotte-Smith*, E. W. C.; Barter*, D.; Redkar, N. S.; Khanwale, A.; Dwaraknath, S.; Persson, K. A.; Blau, S. M. Predictive Stochastic Analysis of Massive Filter-Based Electrochemical Reaction Networks. *Digital Discovery* **2023**, *2* (123), 123–137
- (16) Xie, X.; Leon, N. J.; Small, D. W.; Spotte-Smith, E. W. C.; Liao, C.; Persson, K. A. The Reductive Decomposition Kinetics and Thermodynamics That Govern the Design of Fluorinated Alkoxyaluminate/borate Salts for Mg-Ion and Ca-Ion Batteries. *Journal of Physical Chemistry C* **2022**, *126* (49), 20773–20785
- (17) Spotte-Smith*, E. W. C.; Kam*, R.; Barter, D.; Xie, X.; Hou, T.; Dwaraknath, S.; Blau, S. M.; Persson, K. A. Toward a Mechanistic Model of Solid-Electrolyte Interphase Formation and Evolution in Lithium-Ion Batteries. *ACS Energy Letters* **2022**, *7*, 1446–1453
- (18) Alzate-Vargas, L.; Blau, S.; Spotte-Smith, E. W. C.; Allu, S.; Persson, K. A.; Fattebert, J.-L. Insight into SEI Growth in Li-Ion Batteries Using Molecular Dynamics and Accelerated Chemical Reactions. *Journal of Physical Chemistry C* **2021**, *125* (34), 18588–18596
- (19) Xie, X.; Spotte-Smith, E. W. C.; Wen, M.; Patel, H. D.; Blau, S. M.; Persson, K. A. Data-Driven Prediction of Formation Mechanisms of Lithium Ethylene Monocarbonate with an Automated Reaction Network. *Journal of the American Chemical Society* **2021**, *143* (33), 13245–13258
- (20) Spotte-Smith*, E. W. C.; Blau*, S. M.; Xie, X.; Patel, H. D.; Wen, M.; Wood, B.; Dwaraknath, S.; Persson, K. A. Quantum Chemical Calculations of Lithium-Ion Battery Electrolyte and Interphase Species. *Scientific Data* **2021**, *8* (203)
- (21) Blau, S. M.; Patel, H.; Spotte-Smith, E. W. C.; Xie, X.; Dwaraknath, S.; Persson, K. A. A Chemically Consistent Graph Architecture for Massive Reaction Networks Applied to Solid-Electrolyte Interphase Formation. *Chemical Science* **2021**, *12* (13), 4931–4939

- (22) Wen, M.; Blau, S. M.; Spotte-Smith, E. W. C.; Dwaraknath, S.; Persson, K. A. BonDNet: A Graph Neural Network for the Prediction of Bond Dissociation Energies for Charged Molecules. *Chemical Science* **2021**, *12* (5), 1858–1868
- (23) Hu, J.; Spotte-Smith, E. W. C.; Pan, B.; Garcia, R.; Colosqui, C.; Herman, I. P. Spatiotemporal Study of Iron Oxide Nanoparticle Monolayer Formation at Liquid/liquid Interfaces by Using in-Situ Small Angle X-Ray Scattering. *The Journal of Physical Chemistry C* **2020**, *124* (13), 23949–23963
- (24) Spotte-Smith, E. W. C.; Yu, P.; Blau, S. M.; Jain, A.; Prasher, R. S. Aqueous Diels-Alder Reactions for Thermochemical Storage and Heat Transfer Fluids Identified Using Density Functional Theory. *Journal of Computational Chemistry* **2020**, *41* (24), 2137–2150
- (25) Hu, J.; Spotte-Smith, E. W. C.; Pan, B.; Herman, I. P. Improved Small-Angle X-Ray Scattering of Nanoparticle Self-Assembly Using a Cell with a Flat Liquid Surface. *Journal of Nanoparticle Research* **2019**, *21* (4), 71

Other Publications

- (26) Levine*, D. S.; Shuaibi*, M.; Spotte-Smith, E. W. C.; Taylor, M. G.; Hasyim, M. R.; Michel, K.; Batatia, I.; Csányi, G.; Dzamba, M.; Eastman, P.; Frey, N. C.; Fu, X.; Gharakhanyan, V.; Krishnapriyan, A. S.; Rackers, J. A.; Raja, S.; Rizvi, A.; Rosen, A. S.; Ulissi, Z.; Vargas, S.; Zitnick, C. L.; Blau, S. M.; Wood, B. M. The Open Molecules 2025 (Omol25) Dataset, Evaluations, And Models. *arXiv* 2025
- (27) Spotte-Smith, E. W. C. Considering the Ethics of Large Machine Learning Models in the Chemical Sciences. *ChemRxiv (in review)* **2025**
- (28) Sivonxay, E.; Attia, L.; Spotte-Smith, E. W. C.; Sanchez-Lengeling, B.; Xia, X.; Barter, D.; Chan, E. M.; Blau, S. M. Enabling Inverse Design of Nanoparticle Photophysics via Deep Learning on Heterogeneous Graphs. *ChemRxiv (in review)* **2025**
- (29) Blau*, S.; Spotte-Smith*, E. W. C.; Wood, B.; Dwaraknath, S.; Persson, K. Accurate, Automated Density Functional Theory for Complex Molecules Using on-the-Fly Error Correction. *ChemRxiv* **2020**

Presentations

- (30) Spotte-Smith, E. W. C. Data-Driven Design of Reactive Technologies: Case Studies in Energy Storage. ACS Spring Meeting **2025**
- (31) Spotte-Smith, E. W. C.; Timmins, A.; Kurchin, R. C. Mechanistic Insights into Electrolyte Decomposition during Electrochemical Ammonia Synthesis from Machine-Learning Interatomic Potentials. *ACS Spring Meeting* **2025**
- (32) Spotte-Smith, E. W. C.; Timmins, A.; Kurchin, R. C. Towards Rational Design of Sustainable Technologies with Data-Enabled Reactive Simulations. *Symposium on Responsible and Sustainable AI* **2025**
- (33) Spotte-Smith, E. W. C. Towards Data-Driven Analysis of Sustainable Electrochemical Reactions. *Bosch Research and Technology Center Seminar* **2025**
- (34) Spotte-Smith, E. W. C. Chemical Reaction Network Machine Learning (CRN-ML): A Frontier for Reactivity Studies. *AIMED Workshop on Heterogeneous Catalysis* **2024**
- (35) Spotte-Smith, E. W. C. Datasets to Drive Practical Chemical Data Science. *Gordon Research Conference in Computational Chemistry* **2024**
- (36) Spotte-Smith, E. W. C.; Hegazy, K.; Avaylon, M.; Vargas, S.; Cohen, O. A.; Mahoney, M. W.; Perciano, T.; Persson, K. A.; Blau, S. M. Challenging Molecular Machine Learning with Datasets of Ions and Radicals. *Gordon Research Seminar in Computational Chemistry* **2024**

- (37) Spotte-Smith, E. W. C. Using Networks to Obtain Mechanistic Understanding in Electrochemistry. *Materials Science and Engineering Rising Stars Colloquium Series* **2024**
- (38) Spotte-Smith, E. W. C. Rational Design of Sustainable Chemical Solutions with Reaction Networks and Data Science. *AIChE Annual Meeting* **2023**
- (39) Spotte-Smith, E. W. C.; Blau, S. M.; Barter, D.; Leon, N. J.; Hahn, N. T.; Redkar, N. S.; Zavadil, K. R.; Liao, C.; Persson, K. A. Explaining Gas Evolution Mechanisms in Mg-Ion Batteries with Chemical Reaction Networks. *AIChE Annual Meeting* **2023**
- (40) Spotte-Smith, E. W. C.; Cohen, O.; Blau, S. M.; Munro, J. M.; Kingsbury, R.; Guha, R. D.; Patel, H. D.; Vijay, S.; Yang, R.; Huck, P.; Horton, M. K.; Persson, K. A. MPcules: An Open and Accessible Database of Molecular Properties in the Materials Project. *ACS Fall 2023 Meeting* **2023**
- (41) Spotte-Smith, E. W. C.; Petrocelli, T. B.; Patel, H. D.; Blau, S. M.; Persson, K. A. Revealing the Decomposition Mechanisms of Lithium Hexafluorophosphate in Battery Electrolytes and Interphases by First-Principles Simulations. *ACS Spring 2023 Meeting* **2023**
- (42) Spotte-Smith, E. W. C.; Barter, D.; Kam, R. L.; Liao, C.; Blau, S. M.; Persson, K. A. Explaining Battery Electrolyte Decomposition with Chemical Reaction Networks. *Berkeley Energy & Resources Collaborative Energy Summit* **2023**
- (43) Spotte-Smith, E. W. C. Leveraging Quantum Chemistry and Reaction Networks to Explore Electrochemical Cascades. *Pitzer Center for Theoretical Chemistry Seminar Series* **2022**
- (44) Spotte-Smith, E. W. C. Leveraging Big Data and Chemical Reaction Networks to Explore and Explain Electrochemistry. *ChemE Future Faculty Seminar Series* **2022**
- (45) Spotte-Smith, E. W. C.; Kam, R. L.; Barter, D.; Self, J.; Xie, X.; Hou, T.; Dwaraknath, S.; Blau, S. M.; Persson, K. A. A General Mechanistic Model of Early Solid-Electrolyte Interphase Formation in Lithium-Ion Batteries. *Gordon Research Conference in Electrochemistry* **2022**
- (46) Spotte-Smith, E. W. C.; Kam, R. L.; Barter, D.; Xie, X.; Hou, T.; Dwaraknath, S.; Blau, S. M.; Persson, K. A. Towards a Mechanistic Explanation for Solid Electrolyte Interphase Formation and Evolution in Lithium-Ion Batteries. *American Conference on Theoretical Chemistry* **2022**
- (47) Spotte-Smith, E. W. C.; Kam, R. L.; Barter, D.; Xie, X.; Hou, T.; Dwaraknath, S.; Blau, S. M.; Persson, K. A. Towards a Mechanistic Explanation for Solid Electrolyte Interphase Formation and Evolution in Lithium-Ion Batteries. *21st International Meeting on Lithium Batteries* **2022**
- (48) Spotte-Smith, E. W. C.; Kam, R. L.; Barter, D.; Self, J.; Xie, X.; Hou, T.; Dwaraknath, S.; Blau, S. M.; Persson, K. A. Towards a Mechanistic Explanation for Solid Electrolyte Interphase Formation in Lithium-Ion Batteries. *241st Electrochemical Society Meeting* **2022**
- (49) Spotte-Smith, E. W. C.; Blau, S. M.; Persson, K. A. GPS for the SEI: Charting Electrochemical Mechanisms with Reaction Networks. *241st Electrochemical Society Meeting* **2022**
- (50) Spotte-Smith, E. W. C.; Blau, S. M.; Xie, X.; Wood, B.; Patel, H.; Dwaraknath, S.; Persson, K. A. Automatic Generation of Computational Reaction Networks for Unbiased Exploration of Chemical Pathways. *MRS Spring/Fall Meeting & Exhibit* **2020**
- (51) Spotte-Smith, E. W. C.; Blau, S. M.; Wood, B.; Dwaraknath, S.; Persson, K. A. A Robust Computational Framework for High-Throughput Density Functional Theory Calculations for Electrochemical Application. *PRiME (ECS, ECSJ, & KECS Joint Meeting)* **2020**

(52) Spotte-Smith, E. W. C.; Yu, P.; Jain, A.; Prasher, R. Identifying Diels-Alder Reactions for Aqueous Thermal Storage Using Density Functional Theory. *MRS Spring Meeting and Exhibit* **2019**

Peer Review Experience

- 2025 The Journal of Physical Chemistry (x2), Journal of Materials Chemistry A, ACS Applied Energy Materials, JuliaCon 2025, NAIRR Pilot (x6), European Research Council Synergy Grant
- 2024 The Journal of Open Source Software (x2), Scientific Data, Digital Discovery, Journal of Physics D: Applied Physics, Journal of Chemical Theory and Computation, Journal of Chemical Information and Modeling, Chemical Science
- 2023 ACS Nano, Journal of Chemical Information and Modeling, npj Computational Materials
- 2022 ACS Energy Letters, The Journal of Open Source Software

Organized Symposia & Workshops

- 2025 Chemical Reaction Networks, Retrosynthesis, and Reaction Prediction, ACS Fall Meeting
- 2025 Symposium on Responsible and Sustainable AI, Carnegie Bosch Institute
- 2023 Kavli Career Development Workshop, UC Berkeley

Leadership & Service

- 2025 Topic Editor, The Journal of Open Source Software
- 2025 Mentor, DisabledInSTEM Mentorship Program
- 2022 2023 Materials Science and Engineering Delegate, UC Berkeley Graduate Assembly
- 2022 2023 **Vice-President**, UC Berkeley Materials Science and Engineering Graduate Student Council,

Other Roles: Social Chair

- 2022 2023 Mentor, CalACS College Application and Professional Support
 - 2020, 2021 **Graduate Student Representative**, *Materials Science and Engineering Faculty Search Committee*
 - 2020 **Co-Director**, Interstitials Mentorship Program
- 2016 2019 Academic Advisor, Columbia Educational Simulations
- 2015 2019 President, Columbia University Engineers Without Borders (CU-EWB),
 Other Roles: Engineering Mentor, President, Program Manager, Director of Grants,
 Program Liaison, Director of Operations