OMB No. 3145-0279 (Expiration Date 04/30/2027)

NIH BIOGRAPHICAL SKETCH COMMON FORM

Name: Donovan, Brian Christopher

Persistent Identifier (PID) of the Senior/Key Person: https://orcid.org/0000-0003-2831-0396

Position Title: Postdoctoral Scholar

Organization and Location: Musen Group; School of Medicine; Stanford University , Stanford, California, United States

PROFESSIONAL PREPARATION

INSTITUTION AND LOCATION	DEGREE	Start Date	Completion Date	FIELD OF STUDY
Columbia University, New York City, New York, United States	Doctor of Philosophy (PHD)	08/2022	06/2026	Chemical Engineering
Columbia University, New York City, New York, United States	Master of Science (MS)	08/2022	12/2023	Chemical Engineering
University of California, San Diego, San Diego, California, United States	Bachelor of Science (BS)	08/2019	06/2022	Chemical Engineering; Chemistry; Probability & Statistics

Appointments and Positions

2026 - present	Postdoctoral Scholar, Musen Group; School of Medicine; Stanford University , Stanford, California, United States
2022 - 2026	Graduate Research Fellow, West and Urban Groups; Chemical Engineering; Columbia University, New York City, New York, United States
2021 - 2022	Research Assistant, Jokerst Lab; Nanoengineering; University of California, San Diego, San Diego, California, United States
2021 - 2022	Research Assistant, Molecular Mass Spectroscopy Facility; Chemistry; University of California San Diego, San Diego, California, United States

Products

Products Closely Related to the Proposed Project

1. Retout M, Mantri Y, Jin Z, Zhou J, Noël G, Donovan B, Yim W, Jokerst JV. Peptide-Induced Fractal Assembly of Silver Nanoparticles for Visual Detection of Disease Biomarkers. ACS Nano. 2022 Apr 26;16(4):6165-6175. PubMed Central PMCID: PMC9530071.
2. West A, Banta S, Kim C, Donovan BC, Fitts JP, Sirkoch C., inventors. Columbia University, assignee. Systems and methods to remove waste contaminants from ore concentrates. United States 19398957. 2026 March 19.
3. Xu T, Donovan B, Sirkoch C, Yang Y, Wang Z, Chen C, Kim C, Banta S, Fitts J, West AC. Redox-mediated cerium(IV) leach process selectively extracts nickel from sulifidic ores. Journal of Environmental Chemical Engineering. 2025 December 29; :120962. Available from: https://www.sciencedirect.com/science/article/pii/S2213343725056593
4. Donovan B, Xu T, Wang Z, Kim C, Banta S, Fitts JP, Urban A, West AC. Fast and selective leaching of pyrrhotite in the presence of pentlandite. ACS Sustainable Resource Management. 2025 November 05; 2(11):283-2291. Available from: https://pubs.acs.org/asrmcd/article/2/11/2283/3734183/Fast-and-Selective-Leaching-of-Pyrrhotite-in-the
5. Donovan B, Kindermann C, Musen MA. Preserving Scientific Intent for Reproducible Experiments with AMBER. In Prepation. Forthcoming.

Other Significant Products Highlighting Contributions to Science

1. Donovan B, West A, Urban A. r2SCAN+rVV10+U parameterization for 3d transition metal sulfides for thermochemistry. J Chem Phys. 2025 Jul 21;163(3) PubMed PMID: 40667734.
2. Fu L, Ling C, Jin Z, Luo J, Palma-Chavez J, Wu Z, Zhou J, Zhou J, Donovan B, Qi B, Mishra A, He T, Jokerst JV. Photoacoustic imaging of posterior periodontal pocket using a commercial hockey-stick transducer. J Biomed Opt. 2022 May;27(5) PubMed Central PMCID: PMC9128833.

3. Mantri Y, Tsujimoto J, Donovan B, Fernandes CC, Garimella PS, Penny WF, Anderson CA, Jokerst JV. Photoacoustic monitoring of angiogenesis predicts response to therapy in healing wounds. Wound Repair Regen. 2022 Mar;30(2):258-267. PubMed Central PMCID: PMC8897271.
4. Kim C, Donovan B, Fitts JP, Farinato RS, Nagaraj D, Banta S, West AC. Vanadium (II) reductive upgrading of copper sulfide concentrates via Iron leaching to facilitate stagewise oxidative copper leaching at room temperature. Hydrometallurgy. 2025 October 01; 236. Available from: https://www.sciencedirect.com/science/article/pii/S0304386X2500074X
5. Xu T, Donovan B, Kim C, Banta S, West AC. Leaching mechanism for chalcopyrite in electrochemically regenerated vanadium (II). ACS Sustainable Chemistry & Engineering. 2024 October 17; 12(43):159. Available from: https://pubs.acs.org/ascecg/article/12/43/15913/143801/Leaching-Mechanism-for-Chalcopyrite-in

Certification:

I certify that the information provided is current, accurate, and complete. This includes, but is not limited to, information related to current, pending, and other support (both foreign and domestic) as defined in 42 U.S.C. § 6605.

In accordance with Section 10632 of the CHIPS and Science Act of 2022 (42 U.S.C. § 19232), each individual identified as a senior/key person must certify that they are not a party to a malign foreign talent recruitment program.

Research Security Training Requirement for Federal Award Personnel: In accordance with Section 10634 of the CHIPS and Science Act of 2022 (42 U.S.C. § 19234), each individual identified as a senior/key person must certify that they have completed the requisite research security training that meets the requirements specified in Item 2 of Important Notice No. 149 within 12 months prior to proposal submission.

Misrepresentations and/or omissions may be subject to prosecution and liability pursuant to, but not limited to, 18 U.S.C. §§287, 1001, 1031 and 31 U.S.C. §§3729-3733 and 3802.

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NIH BIOGRAPHICAL SKETCH SUPPLEMENT

Name: Donovan, Brian Christopher

Persistent Identifier (PID) of the Senior/Key Person: https://orcid.org/0000-0003-2831-0396

Position Title: Postdoctoral Scholar

Organization and Location: Musen Group; School of Medicine; Stanford University , Stanford, California, United States

Personal Statement

I am well suited to advance biomedical laboratory automation because my research bridges experimental bioengineering, electrochemistry, computational modeling, and scientific data standards. At the University of California, San Diego, I contributed to peptide-programmed nanoparticle sensors for SARS-CoV-2 protease detection and photoacoustic imaging approaches for studying wound healing and periodontal disease (Retout et al., 2022; Mantri et al., 2022; Fu et al., 2022). I also operated analytical instruments in a molecular mass spectrometry facility, supporting researchers in characterizing proteins and small molecules. These experiences showed me how sample preparation, instrument settings, controls, and data interpretation affect the reliability and reproducibility of biomedical measurements.

During my Ph.D. at Columbia University, supported by a National Science Foundation Graduate Research Fellowship, I combined quantum-mechanical calculations and machine learning with electrochemical and dissolution experiments to investigate the chemical conditions governing selective dissolution of metal sulfides. My first-author studies advanced models of sulfide thermochemistry and demonstrated selective dissolution, while collaborative studies investigated vanadium- and cerium-mediated leaching (Donovan et al., J. Chem. Phys., 2025; Donovan et al., ACS Sustainable Resource Management, 2025; Xu et al., 2024; Xu et al., 2025). This work required precise control and documentation of reaction conditions and measurements, as well as careful comparison of computational predictions with experimental results. It trained me to make assumptions explicit, quantify uncertainty, and distinguish essential scientific requirements from implementation choices.

As a postdoctoral scholar at Stanford Medicine working with Dr. Mark Musen, I apply this breadth of experience to developing AMBER's scientific models and ontologies for standardized, machine-interpretable reporting of biomedical experiments. AMBER links experimental requirements, laboratory actions, and instrument capabilities so that methods can be assessed for completeness rather than merely translated into executable instructions. I have developed an initial model of high-performance liquid chromatography (HPLC) that captures materials, operating conditions, measurement requirements, and dependencies, and implemented a Python prototype to evaluate its coverage of written protocols and identify gaps. My experience with both HPLC-related analytical methods and mass spectrometry is especially relevant to extending AMBER to interconnected techniques such as liquid chromatography–mass spectrometry. Having operated instruments and developed computational models, I can identify consequential scientific details that a technically structured protocol might omit and encode them as testable relationships and constraints. This foundation also informs the proposed development of searchable records linking experimental methods, conditions, and results. By preserving scientific intent across laboratories, this work aims to advance reproducible biomedical research and provide a foundation for reliable automation and self-driving laboratories.

Honors

2023 - 2024	Transformational Leadership Initiative, The Pride Network
2022 - 2026	Graduate Research Fellowship Program, National Science Foundation

Contributions to Science

1. Many biomedical diagnostic methods require sensitive detection of molecular biomarkers or invasive measurements of tissue physiology, but conventional approaches can be limited by equipment requirements, accessibility constraints, or an inability to assess biological changes beneath the surface. At the University of California, San Diego, I synthesized nanoparticles and quantified the colorimetric shifts in developing these peptide-programmed silver nanoparticles whose controlled assembly produces a visible response to protease activity. The resulting platform detected SARS-CoV-2 protease activity at subnanomolar concentrations and distinguished viral proteases in experimentally prepared human samples (Retout et al., 2022).

I also contributed statistical analyses to collaborative photoacoustic imaging research demonstrating that signals associated with angiogenesis could help distinguish healing from nonhealing wounds, and that a compact transducer could measure pocket depth in tooth sockets in previously difficult-to-access locations (Mantri et al., 2022; Fu et al., 2022). These studies advanced approaches to translating molecular and physiological measurements into accessible diagnostic information. Collectively, these projects built my foundation in biomedical assay development, analytical validation, and quantitative measurement.

2. Transition-metal sulfides are important in energy and resource technologies, but their complex electronic structures make phase stability difficult to predict, while selective dissolution of minerals in mixed ores remains a major processing challenge. In my doctoral work, I developed and benchmarked first-principles methods for sulfide thermochemistry, including a systematic correction for transition-metal sulfide systems that reduced formation-energy error by approximately 70% and improved agreement with experimental phase diagrams (Donovan et al., J. Chem. Phys., 2025).

   In parallel, I led experimental work demonstrating that vanadium(II)- and chromium(II)-based solutions can selectively dissolve contaminant iron sulfide phases from nickel-bearing feedstocks in as little as 20 minutes at room temperature while limiting nickel losses to below 5% (Donovan et al., ACS Sustainable Resource Management, 2025). This research contributed to a U.S. patent application, on which I am a named co-inventor, describing systems and methods for removing waste contaminants from ore concentrates (West et al., U.S. Patent Application 19/398,957, 2026). Related collaborative studies investigated the dissolution mechanisms and performance of electrochemically regenerated vanadium and cerium reagents for selective metal extraction (Xu et al., 2024; Xu et al., 2025).

   My contributions included developing computational models and designing and conducting dissolution experiments that supported the development of the technology described in our patent application. Together, these efforts advanced predictive modeling of sulfide materials and demonstrated selective chemical processes for their recovery and extraction.

3. Biomedical laboratory protocols frequently leave scientific requirements, assumptions, and dependencies implicit, limiting reproducibility and complicating automation. Although existing workflow languages can describe executable laboratory procedures, they do not necessarily establish whether an experiment is scientifically complete. To address this challenge, I am developing Abstract Models for Bench Experiment Representation (AMBER), a framework connecting three complementary models: experimental requirements, laboratory actions, and instrument capabilities.

   As a postdoctoral scholar at Stanford Medicine, I developed an initial AMBER model for high-performance liquid chromatography (HPLC), formalizing relationships among experimental materials, operating conditions, measurements, and dependencies. I also implemented a Python prototype to evaluate how completely existing laboratory protocols can be represented and identify missing information. This work provides the foundation for a first-author manuscript in preparation with Christian Kindermann and Mark Musen, examining why executable workflows alone are insufficient for reproducible experimentation and proposing explicit scientific requirements as a complementary approach to existing workflow languages and metadata standards (Donovan et al., manuscript in preparation).

   My contributions establish a foundation for extending standardized representations to additional biomedical techniques and connecting experimental methods, metadata, and results in searchable repositories. By making scientific requirements explicit and independent of particular laboratory implementations, this research aims to improve experimental reproducibility, advance FAIR data practices, and enable more reliable automation and future self-driving biomedical laboratories.

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