

Patrick S. Hume, M.D., Ph.D.

Physician-Scientist

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Instructor of Medicine

Division of Pulmonary, Critical Care and Sleep Medicine

National Jewish Health

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EDUCATION & TRAINING

University of Colorado & National Jewish Health:

Research Fellowship in Pulmonary Sciences & Critical Care

July 2019 – June 2020

Clinical Fellowship in Pulmonary Sciences and Critical Care Medicine

July 2016 – June 2019

Aurora & Denver, CO

Brigham and Women's Hospital, Boston, MA:

July 2013 – June 2016

Internship and Residency in Internal Medicine

Harvard Medical School

University of Colorado: MD, PhD

Aug 2005 – May 2013

Medical Scientist Training Program (Combined MD/PhD Program)

Medical Doctorate awarded: 5/24/2013

Ph.D. in Chemical Engineering awarded: 2/28/2011

Department of Chemical and Biological Engineering, Boulder CO

June 2007 – March 2011

Ph.D. in Chemical Engineering; GPA: 3.8/4.0

University of Colorado: BS in Chemical Engineering

Aug 2001 – May 2005

Bachelor of Science, with High Distinction

Department of Chemical Engineering, Boulder CO

Major: Chemical Engineering; Minor: Biochemistry; GPA: 3.9/4.0

PUBLICATIONS

<https://www.ncbi.nlm.nih.gov/myncbi/1pc5Dvbf3ta/bibliography/public/>

Thomas SM, Bednarek J, Janssen WJ, **Hume PS**. Air-Inflation of Murine Lungs with Vascular Perfusion-Fixation. *J Vis Exp* 2021;di:1–13.

Hume PS, Gibbings SL, Jakubzick CV, Tudor RM, Curran-Everett D, Henson PM, Smith BJ, Janssen WJ. Localization of Macrophages in the Human Lung via Design-based Stereology. *Am J Respir Crit Care Med*. 201:1209–1217 (2020).

Files DC, **Hume PS**, Krall J, Montemayor K, Schmidt EP, King LS. Grant Writing for Clinicians in Training: An Important Career Development Exercise. *Chest* (2019);4–7.

Hume PS, Varon J, Englert JA, Hurwitz S, Klompas M, Baron RM, Rhee C. Trends in “usual care” for septic shock. *Infect Control Hosp Epidemiol*. 39. 1125-1126 (2018).

Hume PS, He J, Haskins K, Anseth KS. Strategies to reduce dendritic cell activation through functional biomaterial design. *Biomaterials*, 33(14):3615-3625 (2012).

Hume PS and Anseth KS, "Polymerizable Superoxide Dismutase Mimic Protects Cells Encapsulated in Poly(ethylene glycol) Hydrogels from Reactive Oxygen Species-Mediated Damage," *Journal of Biomedical Materials Research Part A*, 99A (1), 29-37 (2011).

Hume PS, Bowman CN, and Anseth KS, "Functionalized PEG Hydrogels Through Reactive Dip-Coating for the Formation of Immunoactive Barriers," *Biomaterials*, 32 (26), 6204-6212 (2011).

Hume PS and Anseth KS, "Inducing Local T Cell Apoptosis with Anti-FAS-Functionalized Polymeric Coatings Fabricated Via Surface-Initiated Photopolymerizations," *Biomaterials*, 31, 3166-3174 (2010).

Bonomo J, Wernecke T, **Hume P**, Marizcurrena A, Gill RT. A comparative study of metabolic engineering anti-metabolite tolerance in *Escherichia coli*. *Metab Eng*; 8(3):227-39 (2006).

Leiske DL, Karimpour-Fard A, **Hume PS**, Fairbanks BD, Gill RT. A comparison of alternative 60-mer probe designs in an in-situ synthesized oligonucleotide microarray. *BMC Genomics*; 7:72 (2006).

HONORS & AWARDS

- **First Place Poster Presentation at MOOR Research Retreat.** National Jewish Health. February 2019
- **Reuben M. Cherniack Fellowship.** Research Fellowship from National Jewish Health; 07/2018-07/2020
- **MOOR Basic Science Travel Award.** Travel award from National Jewish Health, Denver CO to attend the Stereology Workshop at the University of Bern, Switzerland; July 2017
- **Gold Headed Cane Award.** Presented annually by the Department of Internal Medicine at the University of Colorado School of Medicine to the most outstanding graduating medical student pursuing Internal Medicine residency; May 2013
- **Student Travel Achievement Recognition (STAR) Award, Society for Biomaterials.** National award from the Society for Biomaterials for outstanding research, presented at their annual conference; April 2010
- **Graduate Assistance in Areas of National Need (GAANN) Fellowship** – Fall 2008 & 2009
- **First Place research presentation at Student Annual Research Symposium,** University of Colorado; October 2008
- **American Chemical Society (ACS) Most Promising Researcher,** Dept. of Chemical Engineering, University of Colorado, Boulder; 2005
- **Norlin Scholars Program,** University of Colorado; 2001-2005

SERVICES ACTIVITIES

- Human Lung Tissue Consortium, Lead coordinator** 01/2019 – Present
- Take 24 hr phone call to screen & accept human donor tissue offers for National Jewish
 - Coordinate requests for human tissue for more than a dozen research groups at National Jewish
 - Dissect and distribute human tissue to investigators across National Jewish and UC Anschutz
- American Thoracic Society, Member** 01/2018 – Present
- Research in Progress Seminar Coordinator** Fall 2017 – Spring 2019
- Arrange speakers for and serve as M.C. at the weekly division-wide seminar series for the Pulmonary & Critical Care divisions at the University of Colorado, Anschutz and National Jewish Health
- Brigham and Women's Internal Medicine, Intern Handbook Editor** 2014 - 2016
- Compiled annual updates to the BWH "Intern Handbook," a comprehensive pocket reference book for each of the inpatient house staff services
- National MD/PhD Student Conference Organizing committee** 2007-2008
- Worked with four students to organize a national conference for over 270 attendees
 - Invited speakers, helped select participant abstracts, served as webmaster, handled all conference registration, and acted as liaison to Keystone resort whereby I managed all scheduling, food, rooms, and AV needs.
- GAANN Retreat Planning Committee, Chair** Spring 2009 - July 2009
- Chaired the committee to plan the summer GAANN fellowship retreat for the University of Colorado to Palisade, CO.
 - Arranged guest speakers and planned all recreational activities in addition to performing numerous logistical duties, coordinating the efforts of the other committee members, and serving as event MC
 - GAANN is a merit-based fellowship program within the department of Chemical Engineering at CU Boulder
- MSTP Administrator Search Committee** Fall 2006
- Served on a committee with 4 other MSTP students & interviewed and selected the current MSTP administrator

PRESENTATIONS & POSTERS

- Hume PS,** Localization of Macrophages in the Human Lung via Design-based Stereology (Invited Oral Presentation). *Stem Cells, Cell Therapies, and Bioengineering in Lung Biology and Diseases Conference.* University of Vermont, VT. July 2021.
- Hume PS,** Identifying Airway Wall Macrophage Subsets Enriched by Cigarette Smoke Exposure (Oral Presentation). *Research in Progress Seminar.* National Jewish Health, Denver, CO. February 2021.
- Hume, PS,** Gibbings, SL, Jakubzick CV, Tuder RM, Curran-Everett D, Henson PM, Smith BJ, Janssen WJ. Localization of Macrophages in the Human Lung via Design-Based Stereology. (Poster). *MOOR Research Symposium,* National Jewish Health, Denver, CO. February 2020.
- Hume PS,** Gibbings S, Henson P, Jakubzick C, Smith B, Janssen W. Localization of Interstitial Macrophages in Human Lungs from Cigarette Smokers and Nonsmokers. (Poster). *American Thoracic Society Annual Conference,* Dallas, TX. May 2019.

- Goel K, **Hume PS**, Schwartz E. Non-Langerhans Histiocytosis: A unique Presentation of Erdheim-Chester and IgG4 Disease. (Poster). *American Thoracic Society Annual Conference*, Dallas, TX. May 2019.
- Hume PS**, Gibbings S, Jakubzick C, Henson P, Janssen WJ. Localization of Macrophages in Human Lungs from Cigarette Smokers and Nonsmokers. (Poster). *MOOR Research Symposium*, National Jewish Health, Denver CO. February 2019.
- Hume PS**, Localizing Interstitial Macrophages in the Lungs of Human Smokers vs Nonsmokers (Oral Presentation). *Research in Progress Seminar*. National Jewish Health, Denver, CO. April 2019.
- Hume PS**, Gibbings S, McCubbrey A, Redente E, Henson P, Jakubzick C, Janssen WJ. Localizing Human Lung Macrophage Subpopulations in Cigarette Smokers vs Nonsmokers (Rapid Oral Presentation). *American Thoracic Society Annual Conference*, San Diego, CA. May 2018.
- Hume PS**, Gibbings S, McCubbrey A, Redente E, Henson P, Jakubzick C, Janssen WJ. Localizing Human Lung Macrophage Subpopulations in Cigarette Smokers vs Nonsmokers (Poster). *MOOR Research Symposium*, National Jewish Health, Denver CO. February 2018.
- Hume PS**, Where are the Interstitial Macrophage Subpopulations in Human Lung? (Oral Presentation). *Research in Progress Seminar*. National Jewish Health, Denver, CO. September 2017.
- Hume PS**, Anseth KS. Photopolymerized coatings to elicit fas-mediated apoptosis. (Oral Presentation). *Society for Biomaterials Annual Conference*, Seattle, WA. April 2010.
- Hume PS**, Anseth KS. Functionalized polymer surfaces for local immunosuppression (Oral Presentation). Student Annual Research Symposium. Boulder, CO. October 2009.
- Hume PS**, Cheung CY, Anseth KS. Synthesis of a polymer brush to generate local T cell immunosuppression. (Oral Presentation) *Student Annual Research Symposium*, University of Colorado. October 2008.
- Hume PS**. How to Prepare for, apply and get into MD and MD/PhD Programs. (Oral Presentation). *CHEN 1300 lecture (Chemical Engineering Freshman Seminar)*. Boulder, CO. March 2008.
- Hume PS**, Anseth KS. Functionalized Biomaterials as Immunoactive Barriers for Islet Transplantation. (Poster). *University of Colorado MSTP 25th Anniversary Research Symposium*, Denver, CO. October 2010.
- Hume PS**, Anseth KS. Modified PEG Hydrogels to reduce dendritic cell activation. (Poster). *National MD/PhD Student Conference*, Keystone CO. August 2010.
- Hume PS**, Anseth KS. Tethering TGF-beta1 to the surface of PEG hydrogels to reduce local dendritic cell activation. (Poster) *Gordon Research Conference, Cell/Material Interactions*. Biddeford, Maine. July 2010.
- Hume PS**, Lin CC, Anseth KS. Functionalized biomaterials for immunosuppression. (Poster). *Mountain West Biomedical Engineering Conference*, Park City UT. May 2010.
- Hume PS**, Anseth KS. T Cell apoptosis induced by functionalized coatings. (Poster). *National MD/PhD Student Conference*, Keystone CO. August 2009.
- Hume PS**, Cheung CY, Anseth KS. Antibody-functionalized polymer surfaces for local T cell immunosuppression. (Poster). *Society for Biomaterials Annual Conference*. San Antonio, TX. April 2009.
- Hume PS**, Cheung CY, Anseth KS. Synthesis of a polymer brush to generate local T cell immunosuppression (Poster) *National MD/PhD Student Conference*. Keystone, CO. August 2008.

RESEARCH ACTIVITIES

Pending Support:

- NIH K08 Fellowship to P. Hume. 1K08HL155894-01. Favorably reviewed and awaiting council review 10/2021. Interstitial Macrophages in cigarette smoke-induced small airway remodeling.

Current Support:

- None

Completed Support:

- NIH F32 NRSA Fellowship to P. Hume. HL145900. 07/2019-07/2020. Stereologic Localization of Interstitial Macrophages in the Lungs of Smokers and Nonsmokers.
- T 32 Appointment by Division of Pulmonary & Critical Care at the University of Colorado, Aurora CO; 07/2017 – 06/2019

Fellowship Research, National Jewish Health, Denver CO

Summer 2017 – Summer 2020

Division of Pulmonary & Critical Care

University of Colorado, Anschutz Medical Campus

Primary mentor: William Janssen, MD

Project: *Using unbiased Stereology to localize human macrophage subpopulations in cigarette smokers vs nonsmokers*

- Using the sampling principles of rigorous, unbiased stereology, I developed methodology to quantify the number and location of interstitial macrophage (IM) subsets in histology sections of fresh human lungs from smokers and healthy nonsmokers
- Forged collaborations across institutions to build expertise in stereology
- Demonstrated that the overwhelming majority of IMs reside in the alveolar septa
- Demonstrate an overall increase in IM number in the lungs of cigarette smokers

Residency Research Project, Brigham and Women's Hospital, Boston, MA Spring 2015 – July 2016

Primary Advisor: Rebecca Baron, MD

Project: *A retrospective analysis of changes to "usual care" for septic ICU patients in the era post Early Goal-Directed Therapy (EGDT)*

- Clinical research project in which I investigated changes in sepsis care in our hospital's medical intensive care unit (ICU) via retrospective chart review
- Coordinating several faculty members from Critical Care & Infectious Diseases
- Showed significantly reduced time from initial triage to both 1 L fluid bolus as well as antibiotics deliver. Further, I showed that the number of patients treated with either fluids or antibiotics prior to the development of hypotension increased significantly since the advent of EGDT

Ph.D. Thesis, University of Colorado, Boulder, CO Jul 2007 – April 2011

Department of Chemical and Biological Engineering

Advisor: Kristi Anseth, Ph.D.

Project: *Improvement of the Immunoisolation Capacity of PEG Hydrogels through Functional Biomaterial Design.*

Abstract: Cell-based therapies are a promising approach for the treatment of diseases such as Type I diabetes mellitus (T1DM), where endogenous insulin production is restored via delivery of insulin-producing β -cells or islet of Langerhans clusters. Tissue rejection by the host's immune system, however, is a major hurdle limiting the broad use of transplanted tissues, so β -cell-based therapies require systemic immunosuppression. To reduce this requirement, tissues have been encapsulated within natural and synthetic barrier materials in a process known as immunoisolation. Immunoisolation materials, including poly(ethylene glycol) (PEG) hydrogels, create physical barriers between host immune cells and donor tissue while enabling the diffusion of small molecules like nutrients and oxygen. Unmodified immunoisolation barriers, however, are unable to prevent the diffusion of small cytotoxic molecules, including reactive oxygen species (ROS) (e.g., superoxide) and cytokines.

This research investigated strategies to introduce immunoactive modifications to PEG hydrogels for the purpose of improving their immunoisolation capacity. Towards this, a polymerizable superoxide dismutase mimetic (SODm) was covalently tethered within β -cell-laden hydrogels to significantly increase cell survival following challenges with superoxide, a major inflammatory mediator of the immune response. Next, photoiniferter chemistry was employed to polymerize PEG chains co-functionalized with an apoptosis inducing factor (anti-fas) and a T cell adhesion ligand (ICAM-1) to locally reduce, through apoptosis, the population of T cells, the adaptive immune responder cells implicated in islet transplant rejection. Further, conformal, immunoactive coatings were formed directly on the surfaces of cell-laden PEG hydrogels using a versatile, reactive dip-coating strategy to present a high density of immunoactive signal while maintaining encapsulated cell cytocompatibility. Finally, towards preventing the development of deleterious adaptive immunity altogether, immunosuppressive hydrogels modified with TGF- β 1 and IL-10 were introduced, and their capacity to reduce dendritic cell maturation was highlighted. The immunoactive materials developed within this thesis suggest innovative strategies for the engineering of future immunoisolation barriers to provide localized and targeted protection of transplanted cells.

Undergraduate Sr Thesis Project, University of Colorado, Boulder CO 2004 – 2005

Advisor: Ryan T. Gill, Ph.D.

Project: *Using random mutagenesis to improve the hydroxamate tolerance of E. coli.*

- Performed random mutagenesis, bacterial MICs & MBCs, and *E. Coli* cell culture

Undergraduate Research Assistant & NSF-REU Recipient, University of Colorado, Boulder CO

Advisor: Ryan T. Gill, Ph.D.

2003 - 2004

Project: *Validating a novel microarray for Burkholderia cenocepacia*

- Used microarrays to characterize and quantify the effects of heat shock on *Burkholderia cenocepacia*.

EDUCATION ACTIVITIES

- CU PSCCM Fellowship Interviewer** Fall 2020-Present
- Airway Management & Intubation Instructor** Fall 2020
- Taught intubation skills to residents of the Internal Medicine Residency at St. Josephs Hospital in Denver, CO. One-on-one instruction and small groups.
- Harvard Medical School MD, PhD Student Rounds Coordinator, Committee Chair** 2015 – 2016
- Coordinated a small group of Brigham and Women’s MD PhD IM residents to run the monthly MD PhD student rounds at Harvard Medical School (HMS). We selected and presented patient cases to accompany research discussions from current HMS MD, PhD students.
- Mentor to undergraduate research assistant** Spring 2009 – April 2011
- Mentored an engineering undergraduate student, teaching skills including cell culture and polymer chemistry as well as working together to write and organizing her successful funding proposals and senior thesis.
- Designed ‘Drug Delivery’ module for high school students** Spring 2009
- Developed a laboratory exercise, worksheet, and PowerPoint presentation to teach the concept of drug elution from biomaterials. Our group ran the module for students in local high school science classrooms and at a University of Colorado recruiting weekend.
- High School Honors Institute Volunteer** July 2008/2009
- Co-ran the HSHI workshop on Tissue Engineering at CU Boulder