

Harvard Medical School Curriculum Vitae

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Place of Birth: Rochester, NY

Education

1993	B.A.	English Literature	Wesleyan University, Middletown, CT
2000	M.D.	Medicine	University of Virginia School of Medicine, Charlottesville, VA

Postdoctoral Training

06/00-06/03	Intern/Resident	Internal Medicine	Brigham and Women's Hospital (BWH), Boston, MA
06/00-06/03	Clinical Fellow	Medicine	Harvard Medical School (HMS), Boston, MA
07/03-06/07	Research/Clinical Fellow	Pulmonary Medicine and Rheumatology, Immunology and Allergy	BWH
07/04-06/07	Research Fellow	Medicine	HMS

Faculty Academic Appointments

07/07-12/13	Instructor	Medicine	HMS
01/14-06/20	Assistant Professor	Medicine	HMS
07/20-present	Associate Professor	Medicine	HMS

Appointments at Hospitals/Affiliated Institutions

07/2007-present	Associate Physician	Rheumatology, Immunology and Allergy	BWH
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Other Professional Positions

2018-present	Consultant	Regeneron Pharmaceuticals, Tarrytown, NY	1 day per year
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Major Administrative Leadership Positions

Local

2007-2009	Course Director, Partners Asthma Center Fellows Forum	BWH
2019-present	Co-director, Single Cell Affinity Group	BWH
2019-present	Course Co-director, "Update on Severe Asthma: Challenges and Opportunities"	BWH / Partners Asthma Center
2020-present	Director, Research Training, Division of Allergy and Clinical Immunology	BWH

Committee Service

Local

2009-present	Selection Committee, Allergy Fellowship Training Program	BWH
2012-present	Allergy Division Steering Committee	BWH
2018-present	Selection Committee, Medicine Residency Program	BWH
2018-present	Partners Asthma Center, Leadership Committee	Partners HealthCare System, Boston, MA
2018-present	Severe Asthma Program	BWH
2019-present	Brigham Research Institute (BRI) Lung Center Advances in Clinical Lung Research Steering Committee	BWH
2020-present	BWH Faculty Animal Users Group	BWH

National

2018	OMICs working group	National Institute of Allergy and Infectious Diseases (NIAID)
2018	Asthma and Allergic Diseases Cooperative Research Centers, Data Sharing Policy Committee	NIAID

Professional Societies

1998-2009	American College of Physicians	Member
2003-2013	American Thoracic Society	Member
2004-present	American Academy of Allergy, Asthma and Immunology (AAAAI)	Member
	2009-2010	Vice Chairman, Cells and Mediators of Allergic Inflammation (CMAI) Subcommittee
	2009-2013	CMAI Representative, Symposia Committee
	2011-2013	Chairman, CMAI Subcommittee
	2013-2014	Member, Basic and Mechanistic Science Presidential Task Force
	2018-present	Member, Basic Science Programming Committee
2013-present	American Association of Immunologists	Member
2017-present	American Lung Association (ALA)	Member
	2017-present	Member, Strategic Research Planning Committee

Grant Review Activities

2017-present	Respiratory Disease Research Review Committee	AAAAI / ALA Member
2019-present	Mentored Clinical and Basic Science Review Committee	National Heart, Lung, and Blood Institute <i>Ad hoc</i> Member
2019	Veni Programme Review Committee	Netherlands Organisation for Health Research and Development <i>Ad hoc</i> Member
2019	Single Cell Genomics Pilot Grant Review Committee	Brigham Research Institute <i>Ad hoc</i> Member
2020	Special Emphasis Panel ZRG1 CVRS-N 03	Center for Scientific Review, NIH <i>Ad hoc</i> Member
2020	Peer Review Committee	Medical Research Council, UK <i>Ad hoc</i> Member

Editorial Activities

***Ad hoc* Reviewer**

American Journal of Respiratory and Critical Care Medicine
Cell Reports

Clinical Experimental Allergy
European Journal of Immunology
Journal of Allergy and Clinical Immunology
Journal of Clinical Investigation
Journal of Immunology
Journal of Respiratory Diseases
Mucosal Immunology
Science Immunology

Honors and Prizes

1998	Alpha Omega Alpha	University of Virginia School of Medicine	Academic Achievement
1998	Research Scholarship	University of Virginia School of Medicine, Department of Pathology	Student Research
2001	Student Teaching Award	BWH Department of Internal Medicine	Clinical Teaching
2005, 2006	Distinguished Excellence in Teaching Award	BWH Department of Internal Medicine	Clinical Teaching
2013	Election to Fellow (FAAAAI)	American Academy of Allergy Asthma and Immunology	Academic Scholarship
2013	Steven and Judy Kaye Young Innovators Award	BWH	Academic Scholarship
2018	Election to Member	Collegium Internationale Allergologicum	Academic Scholarship
2019	AAAAI Foundation and Michael M. Frank, MD FAAAAI Lectureship	American Academy of Allergy Asthma and Immunology	Academic Scholarship

Report of Funded and Unfunded Projects

Funding Information

Past

2005-2010	Mast Cell-derived PGD2 and LTC4 in lung inflammation NHLBI P01 36110 Investigator (PI Joshua Boyce) The major goal of this project was to determine the role of mast cell-derived eicosanoids in mediating diverse inflammatory processes on a cellular level.
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2007-2009	<p>Cysteinyl leukotriene regulation of the afferent pulmonary immune response AAAAI/Altana Two-Year Allergy and Immunology Research Award for Advanced Fellows-in-Training AAAAI Foundation Grant PI The major goal of this project was to examine the role of cysteinyl leukotrienes in dendritic cell functions in vitro and in vivo.</p>
2009-2014	<p>Innate signaling, cysteinyl leukotrienes, and asthma elicited by house dust mite NIAID K08 AI080948 PI The major goal of this project was to determine the role of the C-type lectin Dectin-2 and its downstream signaling pathway in allergic pulmonary inflammation elicited by house dust mite and molds.</p>
2012-2013	<p>Caspase-associated recruitment domain-containing protein 9- (CARD9)- dependent allergic pulmonary inflammation NIAID Opportunity Fund U19AI095219 PI CARD9 is an adaptor protein that mediates signaling from both Dectin-2 and TLR4, two pattern-recognition receptors that recognize house dust mite (HDM). This proposal examined the role of CARD9 in models of HDM-induced pulmonary inflammation, comparing strains deficient for Dectin-2, CARD9, and MyD88 with WT controls.</p>
2016-2018	<p>Allergic pulmonary inflammation through the LTE4 receptor, GPR99 American Lung Association PI The major goal of this project was to define the role of GPR99 in orchestrating epithelial cell activation elicited by a common aeroallergen.</p>
2017-2018	<p>Type 2 mucosal inflammation elicited through an LTE4/GPR99-dependent pathway NIAID R56 AI134989 PI The major goal of this project was to understand an IL-25-dependent pathway triggered by LTE4.</p>
2014-2019	<p>Allergic pulmonary inflammation through the Dectin-2 pathway NHLBI R01 HL120952 PI (\$1,243,998) The major goal of this project is to determine the role of Dectin-2-dependent leukotriene signaling in regulating dendritic cell priming and effector functions in allergic inflammation.</p>

Current

2016-2021	<p>Cysteinyl leukotriene receptor 2 (CysLT2R) regulation of type 2 immunity NIAID U19 AI095219 Project 2 PI (\$1,178,317) The major goals of this project are to define the mechanism by which the type 2 cysteinyl leukotriene receptor CysLT2R drives type 2 inflammation and IL-33- dependent mast cell activation in a murine model of aspirin-exacerbated respiratory disease.</p>
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2017-2021	<p>Role of Leukotriene E4 Receptor GPR99 in Asthma DOD W81XWH-17-1-0527 PI (\$871,362) The major goals of this project are to define the role of mast cells and cysteinyl leukotriene receptors in goblet cell mucin release and goblet cell metaplasia.</p>
2019-2024	<p>Type 2 mucosal inflammation elicited through an LTE4/GPR99-dependent pathway NIAID R01 AI134989 PI (\$1,790,251) The major goal of this project is to define the airway brush cell contribution to inflammation and airway remodeling in murine models and in severe asthma.</p>

Training Grants and Mentored Trainee Grants

2009-2024	<p>Immunologic Basis of Resistance and Hypersensitivity NIAID T32 AI007306 Mentor of James Fernandez, Lora Bankova, Dan Dwyer, Min Lee, and Matthew Gianetti (\$2,428,650) The major goal of this grant is to train the next generation of physician-scientists to advance the diagnosis, management, and prevention of allergic disease.</p>
2017-2020	<p>A novel cysteinyl leukotriene pathway for control of epithelial cell differentiation and function AAAAI Foundation Faculty Development Award Mentor of Lora Bankova (\$240,000) The major goal of this project is to define the role of cysteinyl leukotrienes in epithelial cell function.</p>
2017-2022	<p>The cysteinyl leukotriene E4 receptor, GPR99, orchestrates airway epithelial cell differentiation and Type 2 pulmonary inflammation NIAID K08 AI132723-01 Mentor of Lora Bankova (\$925,000) The major goal of this project is to define a novel epithelial cell differentiation pathway under the control of GPR99.</p>
2018-2019	<p>Characterization of a novel GPCR on murine and human mast cells NIAID Opportunity Fund Award Mentor of Dan Dwyer (\$50,000) The major goal of this project is to define the role of a GPCR on mast cell activation.</p>
2019-2022	<p>Oxysterol Regulation of Mast Cell Biology NIAID K22 Mentor of Dan Dwyer (\$270,000) The major goal of this project is to define the role of EBI2 in murine mast cell migration and activation.</p>

Report of Local Teaching and Training

Teaching of Students in Courses

HMS/HSDM/DMS Courses

2013	Leukotrienes in Asthma: Innate and Adaptive Functions Advanced Principles of Immunology (IMM 202) Immunology Ph.D. Students	HMS 2-hour lecture
2017-present	Allergic Asthma and Food Allergy Immunity in Defense and Disease (PWY 110) Medical Students	HMS 2-hour lecture
2017-present	Urticaria, Angioedema, and Anaphylaxis Immunity in Defense and Disease (PWY 110) Medical Students	HMS 2-hour lecture
2018	MHC Molecules and Antigen Presentation to T Lymphocytes Foundations (PWY 100) Medical Students	HMS 2-hour lecture
2019-present	HMS Immunology Summer Program Undergraduate and Masters Students	HMS 2-hour lecture
2020	Immunopathology of Asthma: Barrier Function and Stromal Signaling (IMM202)	HMS 2-hour lecture

Formal Teaching of Residents, Clinical Fellows and Research Fellows (post-docs)

2007-2014	Difficult to Control Asthma Lecture Allergy Immunology Clinical Fellows	BWH One-hour lecture/1x per year
2009-2011, 2014-2018	Asthma Pathophysiology Lecture Allergy Immunology Clinical Fellows	BWH One-hour lecture/1x per year
2011-2013	Asthma Management Lecture Internal Medicine Residents	BWH One-hour lecture/3x per year
2011-2013	Asthma Diagnosis and Testing Lecture Allergy Immunology Clinical Fellows	BWH/MGH One-hour lecture/2x per year
2012-2018	Biology of Dendritic Cells Lecture Allergy Immunology Clinical Fellows	BWH One-hour lecture/1x per year
2017-2018	Severe Asthma Lecture Allergy Immunology Fellows and Staff	BWH One-hour lecture/1x per year
2018	Navigating a Career as a Physician Scientist Allergy Immunology Fellows and Staff	BWH One-hour lecture
2019	Science in Medicine Lecture	BWH

Clinical Supervisory and Training Responsibilities

2007-present	Inpatient Consult Attending and Daily Supervision of Fellows, Allergy Immunology Service	BWH 4 weeks per year
2008-present	Ambulatory Allergy Immunology Preceptor, Allergy Fellows	BWH One half-session per week/6 months per year
2014-present	Ambulatory Allergy Immunology Preceptor, Internal Medicine Residents	BWH One half-session per week/4x per year
2016-present	Ambulatory Allergy Immunology Preceptor, HMS students	BWH One half-session per week/4x per year

Laboratory and Other Research Supervisory and Training Responsibilities

2008-2010	Supervision of a technician/BWH This led to individual pursuing an M.S. degree.	BWH Daily Mentorship
2010-2012	Supervision of a postdoctoral research fellow/BWH	BWH Daily Mentorship
2013-2014	Supervision of a technician/BWH This led to individual pursuing an M.D. degree.	BWH Daily Mentorship
2014-2018	Faculty Advisor in a standing Scholarly Oversight Committee associated with the Pediatric Pulmonary Fellowship at Massachusetts General Hospital (MGH), Boston, MA	MGH 2-hour meeting/3x per year
2016-present	Teaching Faculty in our T32-sponsored Allergy Research Seminar Series	BWH 90-min meeting/12x per year
2016-present	Teaching Faculty in the Brigham Collaborative Asthma Research Group	BWH 90-min meeting/6x per year
2019-present	Mentor in the Career Development Grant Writing Workshop, the Office for Research Careers, BWH	BWH 2-hour meeting/monthly
2019-present	Faculty Advisor in a Scholarly Advisory Committee associated with the Pulmonary Fellowship at BWH	BWH 2-hour meeting/2x per year

Formally Mentored Harvard Medical, Dental and Graduate Students

2020- Kimmy (Qihua) Ye, M.S. candidate, HMS Program in Immunology. Currently conducting her research these on a project titled “Regulation and Function of Pulmonary Brush Cells”.

Other Mentored Trainees and Faculty

2008-2010 Opu Rahman, PA, Touro College School of Health Sciences, New York, NY
Career stage: post baccalaureate. *Mentor role:* research advisor. *Accomplishments:* published two manuscripts, one in the *Journal of Experimental Medicine* and one in the *Journal of Immunology*.

2010-2012 James Fernandez, M.D., Ph.D./Associate Physician, Cleveland Clinic, Cleveland, OH
Career stage: clinical/research postdoctoral fellow. *Mentor role:* research advisor. *Accomplishments:* published one first-author manuscript in the *Journal of Immunology*.

2011-2013 Matthew Parsons, medical student, University of Cincinnati, Cincinnati, OH
Career stage: post baccalaureate. *Mentor role:* research advisor. *Accomplishments:* published one first-author manuscript in the *Journal of Immunology*.

2013-2016 Min Lee, M.D. / Assistant Professor in Pediatrics and Medicine, University of Texas Southwestern, Dallas, TX
Career stage: clinical/research postdoctoral fellow. *Mentor role:* research advisor. *Accomplishments:* awarded AAAAI Fellow-in-Training Interest Section Award (2015) and published two manuscripts in the *Journal of Immunology*, one of which was a first-author paper.

2014-present Daniel Dwyer, Ph.D. / Instructor, Medicine, HMS; Associate Immunobiologist, BWH
Career stage: postdoctoral fellow. *Mentor role:* research advisor. *Accomplishments:* published one manuscript in *Nature Immunology*, one paper in *Nature*. Awarded an NIH Opportunity Fund Grant (2018) and an NIH K22 (2019).

2014-present Lora Bankova, M.D. / Assistant Professor in Medicine, HMS, Associate Physician, BWH
Career stage: junior faculty. *Mentor role:* research advisor. *Accomplishments:* awarded an NIH Opportunity Fund Grant (2015), a K08 (2017), and a AAAAI faculty development award (2017). Published one manuscript in the *Proceedings of the National Academy of Sciences* and one in *Science Immunology*.

2015-2017 Matthew Giannetti, M.D. / Instructor in Medicine, HMS; Associate Physician, BWH
Career stage: postdoctoral fellow. *Mentor role:* research advisor. *Accomplishments:* Mastocytosis Society Award (2018).

2017-present Sachin Samuchiwal, Ph.D. / Postdoctoral fellow, BWH
Career Stage: postdoctoral fellow. *Mentor role:* research advisor. *Accomplishments:* published one abstract in the *Journal of Allergy and Clinical Immunology* and was selected for an oral presentation at the AAAAI national meeting in 2019.

2018-present Saltanat Ualiyeva, M.D. M.M.Sc. / post baccalaureate, BWH
Career stage: post baccalaureate. *Mentor role:* research advisor. *Accomplishments:* published one manuscript in *Journal of Visualized Experiments* and was selected for an oral presentation at the AAAAI national meeting in 2019.

2018-present	Nils Hallen, B.S., post baccalaureate, BWH <i>Career stage: post baccalaureate. Mentor role: research advisor.</i>
2019-present	Xin Wang, Ph.D. / Postdoctoral fellow, BWH <i>Career stage: postdoctoral fellow. Mentor role: research advisor.</i>
2020-present	Mingkyu Lee, Ph.D. / Postdoctoral fellow, BWH <i>Career stage: postdoctoral fellow. Mentor role: research advisor.</i>

Formal Teaching of Peers (e.g., CME and other continuing education courses)

No presentations below were sponsored by outside entities.

2012-2018	Asthma Diagnosis and Testing Brigham Board Review in Allergy & Immunology, BWH/HMS	One-hour lecture/1x per year Boston, MA
2012-2018	Biology of Dendritic Cells Brigham Board Review in Allergy & Immunology, BWH/HMS	One-hour lecture/1 x per year Boston, MA
2019	Innate Immunity and the Origins of Asthma Update on Severe Asthma Course BWH / Partners Asthma Center	Single presentation Boston, MA
2020	Management of Severe Asthma: A Case-Based Discussion BWH/Partners Asthma Center	Single presentation Boston, MA
2020	Our Approach to Severe Asthma Update on Severe Asthma Course BWH / Partners Asthma Center *this was cancelled due to COVID19	Single presentation Boston, MA
2020	Lung Function Testing in Severe Asthma Update on Severe Asthma Course BWH / Partners Asthma Center *this was cancelled due to COVID19	Single presentation, Boston, MA

Local Invited Presentations

No presentations below were sponsored by outside entities.

2007-2011	Pathophysiology of Asthma Partners Asthma Center, BWH
2008	Difficult to Control Asthma in Pediatrics Partners Asthma Center, BWH
2010	Difficult to Control Asthma/Clinical Conference

Rheumatology, Immunology, Allergy Division, MGH

- 2010 Dendritic Cells in Asthma/Partners Asthma Center Grand Rounds
Pulmonary and Allergy Sections, BWH
- 2011 Dectin-2/CysLT Pathway/Research Seminar
Collaborative Asthma Research Group, BWH
- 2011 Indoor Allergens and Dectin-2-Mediated Pulmonary Inflammation/Research Seminar
Rheumatology, Immunology and Allergy Division, BWH
- 2011 Innate Signaling in Asthma/Research Conference
Allergy Division, Boston Children's Hospital
- 2012 Why are Allergies and Asthma More Prevalent?
Partners Asthma Center, BWH
- 2013 Innate Signaling from House Dust Mite Allergen/ Longwood Immunology Seminar
Dana-Farber Cancer Institute, Boston, MA
- 2015 Cysteinyl Leukotriene Receptors: Afferent Tuning/Research Seminar
Collaborative Asthma Research Group, BWH
- 2017-2018 Biologics in the Treatment of Asthma
Partners Asthma Center, BWH
- 2018 Biologics in the Treatment of Severe Asthma / Grand Rounds
Department of Medicine, Newton-Wellesley Hospital
- 2019 Airway Epithelial Remodeling in the Sinonasal Mucosa
Rheumatology, Immunology, Allergy Division, MGH
- 2020 Deconstructing Stromal-Immune Signaling in the Airway
Single Cell Genomics Seminar Series, BWH

Report of Regional, National and International Invited Teaching and Presentations

Invited Presentations and Courses

No presentations below were sponsored by outside entities.

Regional

- 2011 Innate Signaling and Th2 Immunity to Dust Mite via Dectin-2/Research Symposium
Merck Research Laboratories, Boston, MA

National

- 2009 Innate signaling, cys-LTs, and pulmonary inflammation/Symposium Speaker
AAAAI Meeting, New Orleans, LA

2010	DC and Epithelial Cell Crosstalk/Symposium Speaker AAAAI Meeting, New Orleans, LA
2010	Dendritic Cells and Effectors/Seminar Speaker AAAAI Meeting, New Orleans, LA
2010	Allergen Signaling/Seminar Speaker AAAAI Meeting, New Orleans, LA
2011	Mannose-based Glycans Signaling in Allergic Inflammation/Seminar Speaker AAAAI Meeting, San Francisco, CA
2012	The Role of CARD9 in Models of Dust Mite-Induced Pulmonary Inflammation/Workshop Speaker NIAID Asthma and Allergic Diseases Cooperative Research Centers Meeting, Bethesda, MD
2014	Cysteinyl Leukotrienes are Endogenous Signaling Molecules/Symposia Speaker AAAAI Meeting, San Diego, CA
2014	Innate Signaling in Th2 Immunity to House Dust Mite/Symposia Speaker Swineford Allergy Conference, University of Virginia, Charlottesville, VA
2015	Antigen Processing Pathways: Importance for Atopic Disease/Workshop Speaker AAAAI Meeting, Houston, TX
2015	Strategies for Writing a Fundable NIH Grant/Workshop AAAAI Meeting, Houston, TX
2016	Cysteinyl Leukotriene-Driven Innate Type 2 Pulmonary Inflammation/Workshop Speaker NIAID Asthma and Allergic Diseases Cooperative Research Centers Meeting Bethesda, MD
2016	Sentinel and Constitutive Mast Cell Functions Revealed by the Respiratory Aeroallergen, Alternaria Alternata/Symposia Speaker FASEB Meeting, Palm Beach, FL
2017	LTE4/GPR99 Regulation of Respiratory Epithelial Cell Function/Workshop Speaker Keystone Conference, Keystone, CO
2017	Mast Cell Diversity Recognized Through Gene Expression/Symposia Speaker AAAAI Meeting, Atlanta, GA
2017	Strategies for Writing a Fundable NIH Grant/Workshop Speaker AAAAI Meeting, Atlanta, GA
2017	LTE4/GPR99 Regulation of Respiratory Epithelial Cell Function/Symposia Speaker AAAAI Meeting, Atlanta, GA
2017	Mapping the Spectrum of Type 2 Inflammation in the Nasal Mucosa with Seq- well/Workshop Speaker NIAID Asthma and Allergic Diseases Cooperative Research Centers Meeting Bethesda, MD

2018	Massively Parallel Single Cell RNA-Seq in Clinical Cohorts/Workshop Speaker NIAID Immunology Assays Workshop Bethesda, MD
2018	Strategies for Writing a Fundable NIH Grant/Workshop Speaker AAAAI Meeting, Orlando, FLA
2018	Deconvoluting Chronic Rhinosinusitis with Single Cell Expression Approaches/Symposia Speaker AAAAI Meeting, Orlando, FLA
2018	IL-33 in AERD Pathogenesis/Symposia Speaker AAAAI Meeting, Orlando, FLA
2018	Airway Epithelial Cell Remodeling: from form to function/Seminar Speaker Berne B. Carter Center for Immunology Research, University of Virginia Charlottesville, VA
2019	Single Cell Analysis in Nasal Polyposis/Symposia Speaker AAAAI Meeting, San Francisco, CA
2019	Type 2 Immunity Elicited By Airway Allergens/Symposia Speaker AAAAI Meeting, San Francisco, CA
2019	Deconstructing Mast Cell Stromal Interactions To Infer Function/Visiting Scholar Seattle Children's Hospital, Seattle, WA
2019	Epithelial cell remodeling in the respiratory mucosa/Plenary Speaker The American Association of Immunologists (AAI) Annual Meeting, San Diego, CA
2019	Annual Immunology Program Retreat/Keynote Speaker Washington University in St. Louis, St. Louis, MO
2019	Airway Epithelial Remodeling/Guest Lecturer Division of Allergy and Immunology, Northwestern University Feinberg School of Medicine, Chicago, IL
2020	Strategies for Writing a Fundable NIH Grant/Workshop Speaker AAAAI Meeting, Philadelphia, PA (March 13, 2020) *this was cancelled due to COVID19
2020	Career Paths in Allergy and Immunology/Seminar Speaker AAAAI Meeting, Philadelphia, PA (March 14, 2020) *this was cancelled due to COVID19
2020	A Single-Cell Expression Atlas of Epithelial Cells – Mechanistic Insights into Inflammatory and Allergic Airway Diseases/Plenary Speaker AAAAI Meeting, Philadelphia, PA (March 15, 2020) ** rescheduled to online recording June 5, 2020 due to COVID19
2020	Revisiting Airway Epithelial Remodeling in T2 Inflammation/Invited Speaker Keystone Symposia 2020, Asthma: Making New Discoveries into Better Therapies

Snowbird, Utah (April 6, 2020)
*this was rescheduled due to COVID19

International

- 2009 Innate signaling, CysLTs and pulmonary inflammation/Symposium Speaker
Keystone Symposium on Innate Signaling and DCs, Banff
Alberta, Canada
- 2018 Airway Epithelial Cell Remodeling: from form to function/Symposium Speaker
Collegium Internationale Allergologicum (CIA)
Mallorca, Spain

Report of Clinical Activities and Innovations

Current Licensure and Certification

- 2004 Diplomate, American Board of Internal Medicine
2005 Massachusetts Medical License
2006 Diplomate, American Board of Allergy and Immunology
2016 Diplomate, American Board of Allergy and Immunology

Practice Activities

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| 2007- | Ambulatory Care | Allergy, BWH | One session per week |
| 2007- | Inpatient Consultation | Allergy, BWH | Four weeks per year |

Clinical Innovations

- BWH Severe Asthma Program
2016-present In collaboration with BWH Pulmonary, Gastroenterology, Otolaryngology, and Psychiatry we developed a BWH Severe Asthma Center. This includes development of a webpage for referral, educational materials for patients, patient-reported outcome measures (PROMS) with integration into the electronic medical record (EMR), and a pathway for diagnostic work-up and management of complex patients with airway disease.
- Epic EMR tools for asthma management
2017-2018 These EMR modifications include designing asthma action plans, building patient educational materials, designing templates for providers caring for children and adults with asthma, and facilitating administration of asthma-related biologics across Partners Institutions.
- Asthma Control App Design
2017-2018 This pilot program across BWH pulmonary and allergy assessed the feasibility of utilizing an app for asthma control across a group of patients with severe asthma.

Report of Education of Patients and Service to the Community

Recognition

- 2016-2020 Top Doctors – Allergy Immunology *Boston Magazine*

Report of Scholarship

** denotes co-first or co-senior author; ** denotes first- or co-first author mentee*

Peer-Reviewed Publications in Print or Other Media

Research investigations

1. Kim D, Hsu F, **Barrett NA**, Friend D, Grenningloh R, Ho I, Al-Garawi A, Lam B, Austen K, Kanaoka Y. Cysteinyl leukotrienes are required for the development of Th2 Pulmonary Inflammation. J Immunol. 2006;176:4440-8. PMID: 16547282
2. Castells MC, Tennant NM, Sloane DE, Hsu FI, **Barrett NA**, Hong DI, Laidlaw TM, Legere HJ, Nallamshetty SN, Palis RI, Rao JJ, Berlin ST, Campos SM, Matulonis UA. Hypersensitivity reactions to chemotherapy: outcomes and safety of rapid desensitization in 413 cases. J Allergy Clin Immunol. 2008;122:574-80. PMID: 18502492
3. **Barrett NA**, Maekawa A, Rahman OM, Austen KF, Kanaoka Y. Dectin-2 recognition of house dust mite triggers cysteinyl leukotriene generation by dendritic cells. J Immunol. 2009;182:1119-28. PMCID: PMC3682801
4. Breslow RG, Rao JJ, Xing W, Hong DI, **Barrett NA**, Katz HR. Inhibition of Th2 adaptive immune responses and pulmonary inflammation by leukocyte ig-like receptor B4 on dendritic cells. J Immunol. 2009;184:1003-13. PMCID: PMC2836496
5. **Barrett NA**, Rahman OM, Fernandez JM, Parsons MW, Xing W, Austen KF, Kanaoka Y. Dectin-2 mediates Th2 immunity through the generation of cysteinyl leukotrienes. J Exp Med. 2011;208:593-604. PMCID: PMC3058587
6. **Barrett NA**, Fernandez JM, Maekawa A, Xing W, Li L, Parsons MW, Austen KF, and Kanaoka Y. Cysteinyl Leukotriene 2 Receptor on Dendritic Cells Negatively Regulates Ligand-Dependent Allergic Pulmonary Inflammation. J Immunol. 2012;189:4556-65. PMCID: PMC3478400
7. Parsons MW, Li L, Wallace AM, Lee MJ, Katz HR, Fernandez JM, Saijo S, Iwakura Y, Austen KF, Kanaoka Y, **Barrett NA**. Dectin-2 Regulates the Effector Phase of House Dust Mite-Elicited Pulmonary Inflammation Independently from its Role in Sensitization. J Immunol. 2014; 192(4):1361-71. PMCID: PMC4024442
8. Cardet JC, White AA, **Barrett NA**, Feldweg AM, Wickner PG, Savage J, Bhattacharyya N, Laidlaw TM. Alcohol-induced Respiratory Symptoms are Common in Patients with Aspirin Exacerbated Respiratory Disease. J Allergy Clin Immunol Pract. 2014; 2(2):208-13. PMCID: PMC4018190
9. Tjota MY, Hrusch CL, Blaine KM, Williams JW, **Barrett NA**, Sperling AL. Signaling through FcRy-associated receptors on dendritic cells drives IL-33-dependent TH2-type responses. J Allergy Clin Immunol. 2014; 134(3):706-713.e8. PMCID: PMC4149927
10. Liu T, Kanaoka Y, **Barrett NA**, Feng C, Garofalo D, Lai J, Buchheit K, Bhattacharya N, Laidlaw TM, Katz HR, Boyce JA. Aspirin-Exacerbated Respiratory Disease Involves a Cysteinyl Leukotriene-Driven IL-33-Mediated Mast Cell Activation Pathway. J Immunol. 2015; 195(8):3537-45. PMCID: PMC4592820

11. Bankova LG**, Lai J, Yoshimoto E, Boyce JA, Austen KF, Kanaoka Y*, **Barrett NA***. Leukotriene E4 elicits respiratory epithelial cell mucin release through GPR99. *Proc Natl Acad Sci U S A*. 2016; 113(22):6242-7. PMID: PMC4896673
 12. Sloane D, Govindarajulu U, Harrow-Mortelliti J, Barry W, Hsu FI, Hong D, Laidlaw T, Palis R, Legere H, Bunyavanich S, Breslow R, Wesemann D, **Barrett NA**, Brennan P, Chong HJ, Liu A, Fernandez J, Fanning L, Kyin T, Cahill K, Bankova L, Lynch A, Berlin S, Campos S, Fuchs C, Mayer R, Matulonis U, Castells M. Safety, Costs, and Efficacy of Rapid Drug Desensitizations to Chemotherapy and Monoclonal Antibodies. *J Allergy Clin Immunol Pract*. 2016;4(3):497-504. PMID: 26895621
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1. Bankova L**, **Barrett NA**. Chapter 1: Innate Immunity. In: Burks AW, Holgate ST, O'Hehir RE, Bacharier LB, Broide DH, Khurana Hershey G, Peebles RS, eds. *Middleton's Allergy*, 9th Edition. Amsterdam, Netherlands: Elsevier; 2020 (forthcoming).

Narrative Report

My principal efforts at HMS and in the division of Allergy and Clinical Immunology at BWH are directed to understanding immunopathology in airway disease. I head a basic research laboratory, which uses biochemical and molecular approaches to assess 'type 2' or 'allergic' airway inflammation. The ultimate goal is to define key regulatory features to prevent and treat diseases such as asthma. These activities have led to invitations to speak and to review grant programs on lung disease, innate immunity, and inflammation both nationally and internationally. Clinically, reflecting my training in both Pulmonary Medicine and Allergy Immunology, I see patients with severe asthma and participate in the BWH Severe Asthma Program. The rest of my efforts are devoted to the career development and mentoring of trainees in research.

My research focuses on environmental sensing in the respiratory tract and the innate immune pathways that are critical to the initiation and persistence of respiratory disease. In earlier work, I sought to understand how dendritic cells (DCs) recognize diverse allergens to pattern a prototypical T helper 2 (Th2) response. I defined a family of proinflammatory molecules (cysteinyl leukotrienes, CysLTs) that are essential to the initiation of type 2 inflammation (T2I), and pathways through which these molecules are generated. These studies led to several manuscripts and to a K08 and R01 from NHLBI on the topic. Ultimately our findings and that of other laboratories suggest that the initiation of T2I does not depend on signaling through a discrete class of DC pattern recognition receptors, but rather that it depends on eliciting common endogenous innate proinflammatory pathways in the mucosa, such as CysLT generation.

These findings led us to look broadly at the cell types that can make CysLTs. Here we defined that brush cells, rare specialized "chemosensory" epithelial cells that recognize bacterial quorum sensing molecules, play a surprisingly large role in initiating T2I through their generation of CysLTs and of IL-25. Although brush cells are rare in the naïve host, they expand significantly in T2I. Thus these findings have underscored the central role of airway remodeling in reshaping the capacity of epithelial barrier tissue to protect from to pathogenic insults and to orchestrate inflammation. These findings and others led to my R01 from NIAID on brush cells and to K08 and AAAA awards for my trainee, Dr. Lora Bankova. As brush cells trigger sensory neural activation, Dr. Bankova will be starting her own laboratory focused on the role of brush cell mediators in sensory neural inflammation.

My recent efforts have focused on translating our observations in mouse to human subjects. In a collaboration on nasal polyposis, a type 2 disease, we used single cell RNA sequencing to define the expansion of a stem-like basal epithelial population with distinct transcriptional programs, epigenetic alterations, and effector pathways. This expansion augments the proinflammatory capacity of the epithelium and is the subject of invited reviews in preparation. Ongoing work to understand the stromal-immune interactions that support persistent T2I is part of our current NIAID U19 grant, a K22 grant awarded to my trainee Dan Dwyer, and ongoing collaborations.

A significant supporting activity is Clinical Expertise in respiratory allergy and asthma. I evaluate and manage patients in the BWH Severe Asthma Program, precept fellows in allergy clinic, lecture to residents and fellows about the diagnosis and treatment of severe asthma, lecture in the BWH Board Review in Allergy & Immunology course, co-direct a BWH course on severe asthma, and participate in the development of clinical innovations to enhance asthma care such as EMR-based tools and an asthma app.

My other significant supporting activity is Special Merit in Education. I facilitate the development of physician-scientists by serving as a faculty advisor at research-in-progress trainee presentations and a mentor on our T32 training grant. I participate in scholarly oversight committees, speak in career development workshops for K series trainees, and give seminars to BWH residents and fellows on navigating a career as a physician-scientist. I was recently named Director of Research Training in the

Division of Allergy and Clinical Immunology. As such, I am developing research training tracks to facilitate the scientific development of clinical, translational, and basic science investigators. In addition, I lecture to HMS students, and BWH residents and fellows on innate immunity in the respiratory tract, and asthma pathobiology and management. Finally, I am focused on accelerating physician training in scientific fields that are rapidly advancing, this includes co-developing and co-directing a single cell affinity group for investigators interested in incorporating and advancing single cell technologies in respiratory research.