

Division Data Summary

Research and Training Details

Number of Faculty	14
Number of Joint Appointment Faculty	2
Number of Research Fellows	11
Number of Research Students	6
Number of Support Personnel	44
Direct Annual Grant Support	\$3,406,200
Direct Annual Industry Support	\$350,036
Peer Reviewed Publications	45

Clinical Activities and Training

Number of Clinical Staff	8
Number of Clinical Fellows	7
Number of Other Students	10
Inpatient Encounters	529
Outpatient Encounters	6,669

Division Photo



Row 1: N Zimmermann, A Assa'ad
 Row 2: A Mishra, K Risma, M Rothenberg, L Zuo
 Row 3: YH Wang, A Barski, K von Tiehl

Significant Publications

Boyce JA, Assa'ad A, Burks AW, et al. **Guidelines for the diagnosis and management of food allergy in the United States: report of the NIAID-sponsored expert panel.** *J Allergy Clin Immunol.* 126(6 Suppl): S1-58. Dec, 2010.

This is a landmark set of Guidelines for Food Allergies and divisional faculty member Dr. Amal Assa'ad had a primary role in its preparation.

Munitz A, Cole ET, Beichler A, et al. **Paired immunoglobulin-like receptor B (PIR-B) negatively regulates macrophage activation in experimental colitis.** *Gastroenterology.* 139(2):530-541. Aug, 2010.

This study led by Dr. Simon Hogan, identifies a new inhibitory receptor involved in macrophage proinflammatory cytokine production by macrophages during experimental colitis.

Sherrill JD, Gao PS, Stucke EM, et al. **Variants of thymic stromal lymphopoietin and its receptor associate with eosinophilic esophagitis.** *J Allergy Clin Immunol.* 126(1):160-165 e163. Jul, 2010.

This study led by Dr. Marc Rothenberg, has identified key genetic risk factors and pathways in eosinophilic esophagitis have been identified.

Wang YH, Voo KS, Liu B, et al. **A novel subset of CD4(+) T(H)2 memory/effector cells that produce inflammatory IL-17 cytokine and promote the exacerbation of chronic allergic asthma.** *J Exp Med.* 207(11):2479-2491. Oct 25, 2010.

This study led by Dr. Yui-Hsi Wang, identifies a new pathway for asthma pathogenesis and phenotyping was identified.

Wu D, Ahrens R, Osterfeld H, et al. **Interleukin-13 (IL-13)/IL-13 Receptor α 1 (IL-13R α 1) Signaling**

Regulates Intestinal Epithelial Cystic Fibrosis Transmembrane Conductance Regulator Channel-dependent Cl⁻ Secretion. *J Biol Chem.* 286(15):13357-13369. Apr 15, 2011.

This study implicates a role of the Th2 cytokine IL13 in CFTR Cl⁻ secretion and water absorption, which provides insight into clinical manifestations of food-induced anaphylaxis.

Division Highlights

Genetic Region Identified for a Children's Food Allergy

Division director Marc Rothenberg, MD, PhD, post-doctorate Joseph Sherrill, PhD, and colleagues have identified the first major gene location responsible for eosinophilic esophagitis (EE), a severe, often painful type of food allergy that leaves its victims unable to eat a wide variety of foods (Rothenberg ME, et al. *Nature Genetics.* 2010;42(4):289-91). The genome-wide analysis studies implicated the 5q22 chromosomal locus in the pathogenesis of EE and identified thymic stromal lymphopoietin (TSLP) as the most likely candidate gene in the region with specific genetic variants in TSLP and its receptor specifically linking with EE compared with other allergic diseases (Sherrill JD, et al. *Journal of Allergy and Clinical Immunology.* 126(1):160-165. 2010.).

National Registry to Track Eosinophilic Disorders

A \$1.6 million federal economic stimulus grant awarded by the National Institute of Diabetes and Digestive and Kidney Diseases has helped to launch the Registry for Eosinophilic Gastrointestinal Disorders (REGID), developed by division director Marc Rothenberg, MD, PhD, along with division faculty Pablo Abonia, MD, and CCHMC co-investigators James Franciosi, MD, and Keith Marsolo, PhD; see www.regid.org. The registry is the first of its kind for eosinophilic disorders and will allow participating centers around the nation to build a database of research-accessible clinical information for thousands of patients coping with eosinophilic disorders.

Interleukin 15 Involved in Eosinophilic Esophagitis

A recent study by associate professor Anil Mishra, PhD, research associate Xiang Zhu, PhD, and colleagues has reported the significance of the induced expression and protein levels of interleukin 15 (IL-15) in human and experimental eosinophilic esophagitis (EE). Notably, transcript levels of IL-15 strongly correlated with esophageal eosinophils in patients with active EE and significantly decreased in patients with improved treated EE, and mouse models of allergen-induced EE demonstrated that the IL-15 receptor, IL-15R α , was necessary for the development of EE (Zhu X, et al. *Gastroenterology.* 139(1):182-193.e7. 2010.).

Division Co-director Supports CCHMC's National and Global Mission

During this past year, co-director Amal Assa'ad, MD, has exemplified the national and global mission of Cincinnati Children's Hospital Medical Center (CCHMC) through her far-reaching dedication and valued efforts to improve child health. She has represented CCHMC as an invited speaker at plenary sessions and international symposia at three national meetings in the USA and five international meetings in South America, Europe, Asia, and the Middle East. In addition, she has contributed as a reviewer of the first evidence-based guidelines for food allergy by the World Allergy Organization (WAO), the WAO Diagnosis and Rationale Against Cow Milk Allergy (DRACMA) Guidelines, and as a writer and writing section chair for the NIH Expert Panel on Food Allergy Guidelines.

Mast Cells Regulate Homeostatic Intestinal Epithelial Migration and Barrier Function

A recent study by associate professor Simon Hogan, PhD, graduate student Katherine Groschwitz, and

colleagues has identified a chymase / mast cell protease 4 -dependent mechanism by which mast cells regulate homeostatic intestinal epithelial migration and barrier function (Groschwitz, et al. *Proceedings of the National Academy of Science of the United States of America*. okok106(52):22381-6. 2009.).

Eosinophil Viability Increased in Acidic Microenvironment

A recent study by associate professor Nives Zimmermann, MD, graduate student Leah Kottyan, and colleagues has demonstrated that acidity inhibits eosinophil apoptosis and increases cellular viability in a dose-dependent manner between pH 7.5 and 6.0, mainly via the G protein-coupled receptor 65 (GPR65). Notably, GPR65-deficient mice had attenuated airway eosinophilia and increased apoptosis in two distinct models of allergic airway disease (Kottyan, et al. *Blood*. 114(13):2774-82. 2009.).

Allergic Reaction to Mecermin

A recent case report by division co-director Amal Assa'ad, MD, clinical fellow Kelly Metz, MD, and colleagues details the second case of cutaneous and systemic allergic reaction to mecermin, a recombinant human insulin-like growth factor 1 (IGF-1) approved by the Food and Drug Administration for treatment of growth failure in children with severe primary IGF-1 deficiency (Metz, et al. *Annals of Allergy, Asthma & Immunology*. 103(1):82-3. 2009.)

C-C chemokine receptor type 3 Promising Target for Age-related Macular Degeneration

A recent collaborative research study by division director Marc Rothenberg, MD, PhD, and adjunct assistant professor Ariel Munitz, PhD, has shown promising results for age-related macular degeneration (AMD). Choroidal neovascularisation, the major cause of blindness from AMD, was more effectively reduced by blockade of C-C chemokine receptor type 3 than by blockade of vascular endothelial growth factor A blockade, which is in present clinical use. Additionally, blockade of C-C chemokine receptor type 3 was also less toxic to the retina (Takeda, et al. *Nature*. 460(7252);225-30. 2009.).

T cell Subsets in Experimental Eosinophilic Esophagitis

A recent study by associate professor Anil Mishra, PhD, research associate Xiang Zhu, PhD, and colleagues has demonstrated an imbalance of esophageal effector and regulatory T cell subsets in a mouse model of eosinophilic esophagitis. Esophageal effector T cells increased whereas regulatory T cells decreased in allergen-challenged mice, suggesting that interaction of these T cell subsets may be required for protective and pathogenic immunity in eosinophilic esophagitis (Zhu, et al. *American Journal of Physiology – Gastrointestinal and Liver Physiology*. 297(3):G550-8. 2009.).

Involvement of Mast Cells in Eosinophilic Esophagitis

Whereas prior studies have primarily focused on the role of eosinophils in disease diagnosis and pathogenesis of eosinophilic esophagitis, the involvement of mast cells was investigated in a recent study by division director Marc Rothenberg, MD, PhD, assistant professor J. Pablo Abonia, MD, and colleagues. The investigators identified local mastocytosis and mast cell degranulation in the esophagi of patients with eosinophilic esophagitis, defined an esophageal mast cell-associated transcriptome that is significantly divergent from the eosinophil-associated transcriptome, and provided evidence for the involvement of KIT ligand in the pathogenesis of eosinophilic esophagitis (Abonia, et al. *Journal of Allergy and Clinical Immunology*. 126(1):112-119. 2010.).

Coordinate Interaction Between IL-13 and Epithelial Differentiation Cluster Genes in Eosinophilic Esophagitis

Aiming to uncover molecular explanations for eosinophilic esophagitis pathogenesis, a recent study by division director Marc Rothenberg, MD, PhD, instructor Carine Blanchard, PhD, and colleagues compared epithelial responses between healthy patients and those with eosinophilic esophagitis. Their findings establish that the epithelial response in eosinophilic esophagitis involves a cooperative interaction between IL-13 and expression of epithelial differentiation complex genes (Blanchard, et al. *Journal of Immunology*. 184(7):4033-41. 2010.).

Glucocorticoid-regulated Genes in Eosinophilic Esophagitis

A recent study by division director Marc Rothenberg, MD, PhD, post-doctorate Julie Caldwell, PhD, and colleagues provides evidence that swallowed glucocorticoid treatment directly affects esophageal gene expression in patients with EE. In particular, increased esophageal FK506-binding protein 5 (FKBP51) transcript levels identify glucocorticoid exposure in vivo and distinguish patients with EE who responded to fluticasone propionate treatment from untreated patients with active EE and patients without EE, suggesting that esophageal FKBP51 levels may have diagnostic and prognostic significance in patients with EE (Caldwell, et al. *Journal of Allergy and Clinical Immunology*. 125(4):879-88 e8. 2010.).

Polymorphisms in Sialic Acid-binding Immunoglobulin-like Lectin-8 Associated with Asthma Susceptibility

A recent collaborative research study by division director Marc Rothenberg, MD, PhD, and associate professor Nives Zimmermann, MD, has identified a significant association of polymorphisms in the sialic acid-binding immunoglobulin-like lectin-8 gene with susceptibility to asthma in diverse populations (Gao, et al. *European Journal of Human Genetics*. 18(6):713-9. 2010.).

Arginase I Suppresses Intestinal Inflammation During Acute Schistosomiasis

A recent collaborative research study by division director Marc Rothenberg, MD, PhD, and associate professor Nives Zimmermann, MD, has identified that macrophage-derived arginase I protects hosts from excessive tissue injury caused by worm eggs during acute schistosomiasis by suppressing interleukin 12 / interleukin 23 p40-driven intestinal inflammation (Herbert, et al. *Journal of Immunology*. 184(11):6438-46. 2010.).

Cationic Amino Acid Transporter 2 Regulates Lung Fibrosis in Allergic Airway Inflammation

Using mouse models of allergic airway inflammation and pulmonary fibrosis, a recent study by associate professor Nives Zimmermann, MD, research assistant Kathryn Niese, and colleagues has identified cationic amino acid transporter 2 as a regulator of fibrotic response in the lung (Niese KA, et al. *Respiratory Research*. 11(1):87. 2010.).

Differential Involvement of Interleukin 9/Interleukin 9 Receptor Pathway in Systemic and Oral Antigen-induced Anaphylaxis

Using mouse models of parenteral and oral antigen-induced anaphylaxis, a recent study by associate professor Simon Hogan, PhD, research assistant Heather Osterfeld, and colleagues has identified that parenteral antigen-induced systemic anaphylaxis is mediated by immunoglobulin G and immunoglobulin E - dependent pathways that can occur independently of interleukin 9 / interleukin 9 receptor signaling, whereas oral antigen-induced anaphylaxis is strictly immunoglobulin E-mediated and requires the interleukin 9 / interleukin 9 receptor signaling pathway (Osterfeld H, et al. *Journal of Allergy and Clinical Immunology*. 125(2):469-476.e2. 2010.).

Persistent Rotavirus Vaccine Shedding in Severe Combined Immunodeficiency: A Reason to Screen

A recent case report by division director Marc Rothenberg, MD, PhD, clinical fellow Burcin Uygungil, MD, and colleagues details a case of persistent rotavirus vaccine shedding in a child with previously undiagnosed severe combined immunodeficiency and highlights the need for neonatal screening measures for severe combined immunodeficiency as this case is not an isolated incident (Uygungil, et al. *Journal of Allergy and Clinical Immunology*. 125(1):270-1. 2010.).

Local B Cells and Immunoglobulin E Production in the Esophageal Mucosa in Eosinophilic Esophagitis

A recent study by division director Marc Rothenberg, MD, PhD, post doctorate Maria Vicario-Perez, PhD, and colleagues has demonstrated the heretofore unproven occurrence of both local immunoglobulin class switching to immunoglobulin E and immunoglobulin E production in the esophageal mucosa of patients with eosinophilic esophagitis. Sensitization and activation of mast cells involving local immunoglobulin E may therefore critically contribute to disease pathogenesis (Vicario, et al. *Gut*. 59(1):12-20. 2010.).

Division Collaboration

Gastroenterology » Dr. Mitchell Cohen; Dr. Philip Putnam; Dr. James Franciosi

Cincinnati Children's Center for Eosinophilic Disorders (CCED)

Pathology » Dr. Margaret Collins

Cincinnati Children's Center for Eosinophilic Disorders (CCED)

Immunobiology, Molecular Immunology Center or Autoimmune Genomics » Dr. John Harley

Cincinnati Children's Center for Eosinophilic Disorders (CCED)

Pediatric Informatics » Dr. Keith Marsolo

Cincinnati Children's Center for Eosinophilic Disorders (CCED)

Nutrition »

Cincinnati Children's Center for Eosinophilic Disorders (CCED)

Social Work »

Cincinnati Children's Center for Eosinophilic Disorders (CCED)

Faculty Members

Marc E. Rothenberg, MD, PhD, Professor

Division Director

Research Interests Elucidating the mechanisms of allergic responses in mucosal tissues such as the lung and the gastrointestinal tract with a focus on eosinophilic esophagitis

J. Pablo Abonia, MD, Assistant Professor

Research Interests The role of mast cells in eosinophilic esophagitis

Amal H. Assa'ad, MD, Professor

Clinical Director

Research Interests The occult effect of allergic sensitization to foods on the bronchial hyper-responsiveness seen in asthmatic and the genetic basis of food allergy

Barski Artem, PhD, Assistant Professor

Research Interests Epigenomics of T cells memory

Thomas J. Fischer, MD, Adjunct

Research Interests The pharmacologic management of asthma, immune deficiency diseases

Simon P. Hogan, PhD, Associate Professor

Research Interests To study allergies, food allergies, eosinophil biology & gastrointestinal inflammation

Michelle B. Lierl, MD, Adjunct

Research Interests To reduce environmental tobacco smoke exposure in children with asthma

Anil Mishra, PhD, Associate Professor

Research Interests Understanding the mechanism of aeroallergen-induced allergic responses in the lung and lower gastrointestinal tract

Ariel Munitz, PhD, Adjunct

Research Interests Cytokine receptor signaling in inflammation

Kimberly A. Risma, MD, PhD, Assistant Professor

Research Interests The molecular and cellular bases of primary disorders of immune deficiency and dysregulation, especially as it relates to lymphocyte cytotoxicity

Karl von Tiehl, MD, Assistant Professor

Research Interests Drug allergy; aspirin-exacerbated respiratory disease and other eosinophilic disorders

Yui-Hsi Wang, PhD, Assistant Professor

Research Interests Asthma; food allergy; T cell biology

Nives Zimmermann, MD, Associate Professor

Research Interests The molecular understanding of eosinophil survival in allergic inflammation and asthma

Li Zuo, MD, Instructor

Research Interests To understand the molecular pathogenesis involved in food allergy related disorders.

Joint Appointment Faculty Members

Gurjit Khurana Hershey, MD, Professor

Asthma Research

Research Interests Asthma genetics

Alexandra Filipovich, MD, Professor

Hematology/Oncology Diagnostic Laboratory

Research Interests Primary immunodeficiencies; BMT for primary immunodeficiencies; Hemophagocytic lymphocytosis; Post-BMT immune reconstruction

Clinical Staff Members

- Kalra Harpinder, MD, Staff Physician

Trainees

- Gerald Lee, MD, PL-8, Saint Vincent's Catholic Medical Centers, New York
- Andrew Lindsley, MD, PL-4, Indiana University School of Medicine
- Charles DeBrosse, MD, PL-6, Ohio State University, Ohio
- Zeynep Yesim Kucuk, MD, PGY-5, Istanbul Universitesi, Istanbul Tip Fakultesi

- Terri Moncrief, MD, PGY-5, Washington University School of Medicine, St. Louis
- Burcin Uygungil, MD, PGY-5, University of Connecticut School of Medicine, Connecticut
- Patricia Fulkerson, MD, PhD, PGY-4, University of Cincinnati, College of Medicine, Ohio
- Carine Bouffi, PhD, University of Montpellier, France
- Julie Caldwell, PhD, University of Cincinnati, College of Medicine, Ohio
- Chen Chun-Yu, PhD, University of Rochester, New York
- Gen Kano, PhD, Kyoto Prefectural University of Medicine, Kyoto, Japan
- Hilde Laeremans, PhD, University of Maastricht, The Netherlands
- Eun Jin Lim, PhD, University of Kentucky, Kentucky
- Priya Rajavelu, PhD, University of Madras, India
- Joseph Sherrill, PhD, University of Cincinnati, Ohio
- Lee Jee-Boong, PhD, Ewha Womans University, South Korea
- Ting Wen, PhD, Rutgers University/UMDNJ, New Jersey
- Zhu Xiang, PhD, Nanjing Medical University, Nanjing, Jiangsu Province China
- Katherine Groschwitz, , Xavier University, Ohio
- Hongyan Zhu, , Hubei College of Traditional Medicine, China
- Amanda Beichler, , Ohio Northern University, Ohio
- Bo Liu, , Tsinghua University, Beijing, China`
- Tom Lu, , University of Cincinnati, Ohio
- Leah Kottyan, , Huntingdon College, Alabama

Significant Accomplishments

NIH MERIT Award

Marc Rothenberg, MD, PhD, director of the Division of Allergy and Immunology at Cincinnati Children's, received an NIH MERIT Award from the NIAID to extend funding of his long-standing investigation into "Regulation of Gastrointestinal Eosinophils."

Rothenberg's work seeks to increase understanding of gastrointestinal eosinophils, their involvement in immune responses, and viable methods to block their role in causing disease.

Established in 1986, the Method to Extend Research in Time (MERIT) Award provides long-term support to investigators whose research expertise and contributions are both exceptional and sustainable. It is intended to promote continued ingenuity and to lessen research-associated administrative burdens. Each year, the NIAID awards approximately 12 grants from a pool of hundreds of applicants.

"The backing of our research program through this award will provide us an extraordinary opportunity to enhance our long-term, in-depth pursuit of developing the best therapy and eventual cure for eosinophilic gastrointestinal diseases," Rothenberg says.

National Registry to Track Eosinophilic Disorders

The National Registry for Eosinophilic Gastrointestinal Disorders (REGID) was launched in the past year by J. Pablo Abonia, MD, Assistant Professor of Pediatrics in the Division of Allergy and Immunology, along with colleagues of the Cincinnati Center for Eosinophilic Disorders (CCED) and the Division of Pediatric Informatics.

REGID (www.regid.org) is a collaboration of medical centers, professionals, families and individuals whose

mission is to improve the knowledge, research, and outcomes for people living with gastrointestinal disorders.

REGID is not only a national registry of people affected by eosinophilic gastrointestinal disorders, but also a forum to enhance the connection of people to resources and research. REGID is funded by the National Institute of Diabetes and Digestive Kidney Diseases (NIDDK).

REGID studies are designed to expand the knowledge of eosinophilic gastrointestinal disorders and the outcomes of different treatments. To this end, researchers test specific hypothesis and therapies. "This innovative registry is the first of its kind," Abonia says.

MTV True Life Series

Karl von Tiehl, MD, Assistant Professor of Pediatrics in the Division of Allergy and Immunology, was highlighted in the MTV series "True Life: I'm Allergic to Everything," which premiered an episode featuring a Cincinnati Children's patient who has an eosinophilic disorder and is in the midst of food trials to increase the number of foods that are safe for him to eat.

Division Publications

1. Abonia JP, Blanchard C, Butz BB, Rainey HF, Collins MH, Stringer K, Putnam PE, Rothenberg ME. **Involvement of mast cells in eosinophilic esophagitis**. *J Allergy Clin Immunol*. 2010; 126:140-9.
2. Abonia JP, Castells M. **Drug allergy in pediatric patients**. *Pediatr Ann*. 2011; 40:200-4.
3. Arumugam M, Ahrens R, Osterfeld H, Kottyan LC, Shang X, MacLennan JA, Zimmermann N, Zheng Y, Finkelman FD, Hogan SP. **Increased susceptibility of 129SvEvBrd mice to IgE-Mast cell mediated anaphylaxis**. *BMC Immunol*. 2011; 12:14.
4. Assa'ad A. **Diagnosed in the allergy and immunology clinic**. *Pediatr Ann*. 2011; 40:224-7.
5. Baye TM, Butsch Kovacic M, Biagini Myers JM, Martin LJ, Lindsey M, Patterson TL, He H, Ericksen MB, Gupta J, Tsoras AM, Lindsley A, Rothenberg ME, Wills-Karp M, Eissa NT, Borish L, Khurana Hershey GK. **Differences in candidate gene association between European ancestry and African American asthmatic children**. *PLoS One*. 2011; 6:e16522.
6. Blanchard C, Stucke EM, Rodriguez-Jimenez B, Burwinkel K, Collins MH, Ahrens A, Alexander ES, Butz BK, Jameson SC, Kaul A, Franciosi JP, Kushner JP, Putnam PE, Abonia JP, Rothenberg ME. **A striking local esophageal cytokine expression profile in eosinophilic esophagitis**. *J Allergy Clin Immunol*. 2011; 127:208-17, 217 e1-7.
7. Boyce JA, Assa'ad A, Burks AW, Jones SM, Sampson HA, Wood RA, Plaut M, Cooper SF, Fenton MJ. **Guidelines for the Diagnosis and Management of Food Allergy in the United States: summary of the NIAID-sponsored expert panel report**. *J Am Diet Assoc*. 2011; 111:17-27.
8. Boyce JA, Assa'ad A, Burks AW, Jones SM, Sampson HA, Wood RA, Plaut M, Cooper SF, Fenton MJ, Arshad SH, Bahna SL, Beck LA, Byrd-Bredbenner C, Camargo CA, Jr., Eichenfield L, Furuta GT, Hanifin JM, Jones C, Kraft M, Levy BD, Lieberman P, Luccioli S, McCall KM, Schneider LC, Simon RA, Simons FE, Teach SJ, Yawn BP, Schwaninger JM. **Guidelines for the diagnosis and management of food allergy in the United States: summary of the NIAID-sponsored expert panel report**. *Nutr Res*. 2011; 31:61-75.
9. Boyce JA, Assa'ad A, Burks AW, Jones SM, Sampson HA, Wood RA, Plaut M, Cooper SF, Fenton MJ, Arshad SH, Bahna SL, Beck LA, Byrd-Bredbenner C, Camargo CA, Jr., Eichenfield L, Furuta GT, Hanifin JM, Jones C, Kraft M, Levy BD, Lieberman P, Luccioli S, McCall KM, Schneider LC, Simon RA, Simons FE, Teach SJ, Yawn BP, Schwaninger JM. **Guidelines for the diagnosis and management of food allergy in the United States: report of the NIAID-sponsored expert panel**. *J Allergy Clin Immunol*. 2010; 126:S1-58.

10. Boyce JA, Assa'ad A, Burks AW, Jones SM, Sampson HA, Wood RA, Plaut M, Cooper SF, Fenton MJ, Arshad SH, Bahna SL, Beck LA, Byrd-Bredbenner C, Camargo CA, Jr., Eichenfield L, Furuta GT, Hanifin JM, Jones C, Kraft M, Levy BD, Lieberman P, Luccioli S, McCall KM, Schneider LC, Simon RA, Simons FE, Teach SJ, Yawn BP, Schwaninger JM. **Guidelines for the Diagnosis and Management of Food Allergy in the United States: Summary of the NIAID-Sponsored Expert Panel Report.** *J Allergy Clin Immunol.* 2010; 126:1105-18.
11. Broide DH, Finkelman F, Bochner BS, Rothenberg ME. **Advances in mechanisms of asthma, allergy, and immunology in 2010.** *J Allergy Clin Immunol.* 2011; 127:689-95.
12. Calabria C, Caldwell JW, Gonzalez-Reyes E, Karamchandani-Patel G, Kujawska A, Mbutia JW, Phillips JF, Sriaroon P, Uzzaman A, Vasudev M, Zuo L. (2010) **Immunological Disorders.** ACAAI Review for the Allergy and Immunology Boards. Arlington Heights, IL, ACAAI (American College of Allergy, Asthma & Immunology). 289-400.
13. Calabria C, Commins SP, Gerrish PK, Gonzalez-Reyes E, Heltzer ML, Karamchandani-Patel G, Kujawska A, Misiak RT, Tzanetos D, Zuo L. (2010) **Hypersensitivity Disorders.** ACAAI Review for the Allergy and Immunology Boards. Arlington Heights, IL, ACAAI. 191-282.
14. Corrigan CJ, Wang W, Meng Q, Fang C, Wu H, Reay V, Lv Z, Fan Y, An Y, Wang YH, Liu YJ, Lee TH, Ying S. **T-helper cell type 2 (Th2) memory T cell-potentiating cytokine IL-25 has the potential to promote angiogenesis in asthma.** *Proc Natl Acad Sci U S A.* 2011; 108:1579-84.
15. Cortina S, McGraw K, Dealarcon A, Ahrens A, Rothenberg ME, Drotar D. **Psychological Functioning of Children and Adolescents With Eosinophil-Associated Gastrointestinal Disorders.** *Child Health Care.* 2010; 39:266-278.
16. DeBrosse CW, Collins MH, Buckmeier Butz BK, Allen CL, King EC, Assa'ad AH, Abonia JP, Putnam PE, Rothenberg ME, Franciosi JP. **Identification, epidemiology, and chronicity of pediatric esophageal eosinophilia, 1982-1999.** *J Allergy Clin Immunol.* 2010; 126:112-9.
17. DeBrosse CW, Zuo L. **Eosinophilic Enteritis.** *Diarrhea: diagnostic and therapeutic advances.* New York: Humana Press; 2010: 81-91. .
18. Fiocchi A, Schunemann HJ, Brozek J, Restani P, Beyer K, Troncone R, Martelli A, Terracciano L, Bahna SL, Rance F, Ebisawa M, Heine RG, Assa'ad A, Sampson H, Verduci E, Bouygue GR, Baena-Cagnani C, Canonica W, Lockey RF. **Diagnosis and Rationale for Action Against Cow's Milk Allergy (DRACMA): a summary report.** *J Allergy Clin Immunol.* 2010; 126:1119-28 e12.
19. Han X, Gilbert S, Groschwitz K, Hogan S, Jurickova I, Trapnell B, Samson C, Gully J. **Loss of GM-CSF signalling in non-haematopoietic cells increases NSAID ileal injury.** *Gut.* 2010; 59:1066-78.
20. Lacy P, Willetts L, Kim JD, Lo AN, Lam B, Maclean EI, Moqbel R, Rothenberg ME, Zimmermann N. **Agonist Activation of F-Actin-Mediated Eosinophil Shape Change and Mediator Release Is Dependent on Rac2.** *Int Arch Allergy Immunol.* 2011; 156:137-147.
21. Lanphear BP, Hornung RW, Khoury J, Yolton K, Lierl M, Kalkbrenner A. **Effects of HEPA air cleaners on unscheduled asthma visits and asthma symptoms for children exposed to secondhand tobacco smoke.** *Pediatrics.* 2011; 127:93-101.
22. Lierl MB. **Allergen immunotherapy: shots for asthma, wheezing, and bee sting.** *Pediatr Ann.* 2011; 40:192-9.
23. Lim EJ, Lu TX, Blanchard C, Rothenberg ME. **Epigenetic Regulation of the IL-13-induced Human Eotaxin-3 Gene by CREB-binding Protein-mediated Histone 3 Acetylation.** *J Biol Chem.* 2011; 286:13193-204.
24. Miles MV, Putnam PE, Miles L, Tang PH, DeGrauw AJ, Wong BL, Horn PS, Foote HL, Rothenberg ME. **Acquired coenzyme Q10 deficiency in children with recurrent food intolerance and allergies.** *Mitochondrion.* 2011; 11:127-35.

25. Munitz A, Cole ET, Beichler A, Groschwitz K, Ahrens R, Steinbrecher K, Willson T, Han X, Denson L, Rothenberg ME, Hogan SP. **Paired immunoglobulin-like receptor B (PIR-B) negatively regulates macrophage activation in experimental colitis.** *Gastroenterology*. 2010; 139:530-41.
26. Rani R, Smulian AG, Greaves DR, Hogan SP, Herbert DR. **TGF-beta limits IL-33 production and promotes the resolution of colitis through regulation of macrophage function.** *Eur J Immunol*. 2011; .
27. Rayapudi M, Mavi P, Zhu X, Pandey AK, Abonia JP, Rothenberg ME, Mishra A. **Indoor insect allergens are potent inducers of experimental eosinophilic esophagitis in mice.** *J Leukoc Biol*. 2010; 88:337-46.
28. Rothenberg ME. **Innate sensing of nickel.** *Nat Immunol*. 2010; 11:781-2.
29. Sackesen C, Assa'ad A, Baena-Cagnani C, Ebisawa M, Fiocchi A, Heine RG, Von Berg A, Kalayci O. **Cow's milk allergy as a global challenge.** *Curr Opin Allergy Clin Immunol*. 2011; 11:243-248.
30. Sherrill JD, Gao PS, Stucke EM, Blanchard C, Collins MH, Putnam PE, Franciosi JP, Kushner JP, Abonia JP, Assa'ad AH, Kovacic MB, Biagini Myers JM, Bochner BS, He H, Hershey GK, Martin LJ, Rothenberg ME. **Variants of thymic stromal lymphopoietin and its receptor associate with eosinophilic esophagitis.** *J Allergy Clin Immunol*. 2010; 126:160-5 e3.
31. Simon D, Wardlaw A, Rothenberg ME. **Organ-specific eosinophilic disorders of the skin, lung, and gastrointestinal tract.** *J Allergy Clin Immunol*. 2010; 126:3-13; quiz 14-5.
32. Simon HU, Rothenberg ME, Bochner BS, Weller PF, Wardlaw AJ, Wechsler ME, Rosenwasser LJ, Roufosse F, Gleich GJ, Klion AD. **Refining the definition of hypereosinophilic syndrome.** *J Allergy Clin Immunol*. 2010; 126:45-9.
33. Sivaprasad U, Warriar MR, Gibson AM, Chen W, Tabata Y, Bass SA, Rothenberg ME, Khurana Hershey GK. **IL-13Ralpha2 has a protective role in a mouse model of cutaneous inflammation.** *J Immunol*. 2010; 185:6802-8.
34. Spanier AJ, Kahn RS, Hurnung RW, Lierl MB, Lanphear BP. **Associations of FeNO with Beta Agonist Use in Children with Asthma.** *Pediatric Allergy, Immunology, and Pulmonology*. 2011; 24:45-50.
35. Stein ML, Munitz A. **Targeting interleukin (IL) 5 for asthma and hypereosinophilic diseases.** *Recent Pat Inflamm Allergy Drug Discov*. 2010; 4:201-9.
36. Steinbrecher KA, Harmel-Laws E, Garin-Laflam MP, Mann EA, Bezerra LD, Hogan SP, Cohen MB. **Murine guanylate cyclase C regulates colonic injury and inflammation.** *J Immunol*. 2011; 186:7205-14.
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43. Zhu H, Perkins C, Mingler MK, Finkelman FD, Rothenberg ME. **The role of neuropeptide S and neuropeptide S receptor 1 in regulation of respiratory function in mice.** *Peptides*. 2011; 32:818-25.
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Grants, Contracts, and Industry Agreements

Grant and Contract Awards	Annual Direct / Project Period Direct
BEICHLER, A	
AGA: Graduate Student Award 2009 AGA Foundation for Digestive Health & Nutrition	
07/01/09-06/30/11	\$20,000
CALDWELL, J	
Molecular Mechanisms of Glucocorticoids and FKBP51 in Inflammation American Heart Association	
07/01/09-06/30/11	\$45,000
FULKERSON, P	
Role of Spi-C in Eosinophil Development and Functional Responses National Institutes of Health K08 AI 093673	
02/04/11-01/31/16	\$84,096
GROSCHWITZ, K	
Mast Cell-Mediated Intestinal Permeability National Institutes of Health F30 DK 082113	
07/01/08-06/30/11	\$32,792
HOGAN, S	
Interleukin-9 in Experimental Intestinal Anaphylaxis National Institutes of Health R01 AI 073553	
04/01/08-03/31/12	\$222,750
KUCUK, Z	
Immunology/Allergy Fellowship Training Grant National Institutes of Health(University of Cincinnati) T32 AI 060515	
07/01/09-05/31/11	\$47,940
KUO, C	
Roles of CC Chemokine Activity in Mast Cell Responses and Ocular Allergy National Institutes of Health(University of Cincinnati) R01 EY019630	
08/01/09-07/31/13	\$226,756
LU, T	
miR-21 in the Pathogenesis of Asthma National Institutes of Health	

MONCRIEF, T**ACAAI Clinical Fellowship**

American College of Allergy, Asthma & Immunology

07/01/09-09/30/11

\$50,000

MUNITZ, A**2B4 & SH2D1B: Novel Regulators of Eosinophil: Epithelial Cell Interactions in Eosinophilic Esophagitis**

American Partnership for Eosinophilic Disorder

02/01/11-01/31/12

\$50,000

RISMA, K**The Functional Consequences of Incomplete Perforin Processing**

American Academy of Allergy, Asthma & Immunology

07/01/09-06/30/12

\$100,000

Proteolytic Maturation of Perforin: Determining the Requirements for Cytotoxic Function

Histiocytosis Association of America

01/01/11-12/31/11

\$47,500

Center for Career Development for Women in Academic Pediatrics

Charlotte R. Schmidlapp Fund, Trustee

01/1/09-12/31/11

\$50,000

ROTHENBERG, M**A Multi-center Clinical Trial of 1760 Mcg of Daily Swallowed Fluticasone vs. Placebo**

National Institutes of Health

U01 AI 088806

09/26/09-08/31/11

\$202,944

IL-13 Associated Eosinophil Lung Responses

National Institutes of Health

R01 AI 083450

08/20/09-07/31/14

\$247,500

Immunobiology of Peanut Allergy and its Treatment: A Prototype

National Institutes of Health(Mount Sinai Medical Center)

U19 AI 066738

07/01/10-06/30/15

\$341,876

Regulation of Gastrointestinal Eosinophils

National Institutes of Health

R37 AI 045898

12/01/10-11/30/14

\$222,750

Genetic Studies of Food Allergies Research Program

U.S. Department of Defense

W81XWH1010167

03/01/10-02/28/12

\$246,436

IL-13 and Eosinophilic Esophagitis

National Institutes of Health

R01 DK 076893

09/01/07-06/30/12

\$198,891

Cincinnati Center for Clinical and Translational Sciences and Training (Education/K12 Training Program)

National Institutes of Health(University of Cincinnati)

UL1 RR 026314

04/03/09-03/31/14

\$39,647

STRAUSS, A / ROTHENBERG, M**Pediatric Center for Gene Expression and Development**

National Institutes of Health

K12 HD 028827

04/01/07-11/30/11

\$400,000

WANG, Y**The Roles of IL-17-producing TH2 Memory/Effector Cells in Allergic Asthma**

American Lung Association

07/01/10-06/30/12

\$50,000

Regulation of TH2 Memory/Effector Cells During Allergic Inflammation

National Institutes of Health

R01 AI 090129	05/01/10-04/30/15	\$247,500
ZIMMERMANN, N		
Mechanism of Airway Acidification in Asthma		
American Lung Association		
	07/01/10-06/30/12	\$50,000
Role of Acidity and GPR65 in Food Allergy		
National Institutes of Health		
R21 AI 088559	03/03/10-02/28/12	\$148,500
	Current Year Direct	\$3,406,200
Industry Contracts		
ABONIA, J		
Ception Therapeutics, Inc		\$207,819
MISHRA, A		
Axcan Pharma, Inc.		\$13,860
ROTHENBERG, M		
Novartis Pharmaceuticals		\$125,523
GlaxoSmithKline		\$2,834
	Current Year Direct Receipts	\$350,036
	Total	\$3,756,236