## Division Data Summary

### Research and Training Details

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### Clinical Activities and Training

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## Significant Publications


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.


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


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


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 (alpha)1 (IL-13R{alpha}1) Signaling

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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

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 Sherill, 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-15Rα, 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 Mecasermin**

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 mecasermin, 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 respiratry 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
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**


35. Stein ML, Munitz A. Targeting interleukin (IL) 5 for asthma and hypereosinophilic diseases. Recent Pat Inflamm Allergy Drug Discov. 2010; 4:201-9.


Grants, Contracts, and Industry Agreements

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<td>miR-21 in the Pathogenesis of Asthma</td>
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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
01/01/11-12/31/11 $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 12/01/10-11/30/11 $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/Effecter Cells in Allergic Asthma
American Lung Association
07/01/10-06/30/12 $50,000

Regulation of TH2 Memory/Effecter Cells During Allergic Inflammation
National Institutes of Health
### ZIMMERMANN, N

**Mechanism of Airway Acidification in Asthma**
American Lung Association

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**Role of Acidity and GPR65 in Food Allergy**
National Institutes of Health

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**Current Year Direct** $3,406,200

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**Current Year Direct Receipts** $350,036

**Total** $3,756,236