Immunobiology

Division Photo

Front Row: M. Jordan, S.Morris, M. Wills-Karp, H. L. Grimes
Back Row: F. Finkelman, J. Mattner, D. Hildeman

Division Data Summary

Research and Training Details

Number of Faculty	6
Number of Joint Appointment Faculty	3
Number of Research Fellows	10
Number of Research Students	7
Number of Support Personnel	25
Direct Annual Grant Support	$3,267,367
Direct Annual Industry Support	$31,390
Peer Reviewed Publications	25

Faculty Members

Marsha Wills-Karp, PhD, Professor ; *Division Director; Director of Immunobiology Graduate Program; Associate Dean for Basic Science and Special Projects - UCCOM*

Fred Finkelman, MD, Professor

H. Leighton Grimes, PhD, Associate Professor ; *Director Cancer Pathology Program*

David A. Hildeman, PhD, Assistant Professor

Michael B. Jordan, MD, Assistant Professor

Jochen Mattner, MD, Assistant Professor

Joint Appointment Faculty Members

Eman Al-Khadra, MD, Assistant Professor
Critical Care Medicine

Amy Nathan, MD, Assistant Professor
Neonatology and Pulmonary Biology

Kristen Page, PhD, Associate Professor
Critical Care Medicine

Trainees

- **Pulak Tripathi, PhD,** PGY-5,
- **Adora Lin, BS,** GS-5,
- **Vanessa Saunders, BS,** GS-5,
- **Marat Khodoun, PhD,** PGY-4,
- **Ian Lewkowich, PhD,** PGY-4,
- **Erin Zoller, BS,** GS-4,
- **Chinavenmeni Velu, PhD,** PGY-3,
- **James Phelan, BS,** GS-3,
- **Meghan Rojas, BS,** GS-3,
- **Stephane Lajoie, PhD,** PGY-2,
- **Sema Kurtulus, BS,** GS-2,
- **Aditya Chaubey, PhD,** PGY-1,
- **Yuzaburo Inoue, MD/PhD,** PGY-1,
- **Theodore Johnson, MD,** PGY-1,
- **Yusuke Suzuki, PhD,** PGY-1,
- **Robert Thacker, MD,** PGY-1,
- **Mark Webb, BS,** GS-1,

Significant Accomplishments in FY08

Identification of Novel Allergen Receptor

Dr. Wills-Karp and Dr. Nathan have discovered a novel b-glucan receptor for the common allergen, house dust mite. This finding represents a fundamental shift in our understanding of the mechanisms by which allergens induce allergic diseases and may lead to the development of new therapies for the treatment of asthma.

Determination of Mechanisms Underlying Severe Reactions to Peanuts

This year, Drs. Finkelman and Khodoun have discovered a potential explanation for why individuals with peanut allergies develop shock and asthma, whereas most food allergies result only in skin or gastrointestinal symptoms. Specifically, they have found that peanut extracts directly cause shock, even in the absence of the IgE and IgG antibodies that cause anaphylaxis. This effect was shown to result from activation of complement pathways leading to PAF production. They have received an R21 grant to further identify the exact component in peanuts that activate complement and induce shock. This work has the potential to guide therapeutic approaches for severe reactions to peanuts. Furthermore, there are some indications that a similar may also contribute to the allergenicity of important causes of drug allergy, such as penicillin, and insect venom allergy (e.g., bee sting allergy). This work has drawn considerable media attention, including reports on National Public Radio, two local television network affiliate, and newspaper articles.

Association of Novel Mutations in GFi1 with Severe Congenital Neutropenia

Dr. Grimes and his laboratory have identified mutations in the GFi1 gene that are associated with the development of severe congenital neutropenia. This discovery brings us closer to the development of therapeutis for the treatment of this debilitating disease.

Significant Publications in FY08

Zarebski A, Velu CS, Baktula AM, Bourdeau T, Horman SR, Basu S, Bertolone SJ, Horwitz M, Hildeman DA, Trent JO, Grimes HL. Mutations in growth factor independent-1 associated with human neutropenia block murine granulopoiesis through colony stimulating factor-1. Immunity 2008, 28:370-380.

Dr. Grimes' research team studies the Growth factor independent-1 (Gfi1) transcription factor. This year, they reported in *Immunity* that mutations in GFi1 are causal for Severe Congenital Neutropenia (SCN), a condition that results in recurrent bacterial and fungal infections. Specifically, they showed that the GFi1 mutation (Gfi1N382s) inhibits DNA binding and results in a dominant negative block to granulopoiesis. Moreover, this mutation selectively derepresses the monopoietic cytokine CSF1 and its receptor. Antibody absorption of Csf1 permits GFi1N382s-expressing cells to form neutrophils. Expression of Gfi1 mutants in primary stem/progenitor cells illustrates a central transcriptional program controlling neutrophil development relevant to the pathogenesis of SCN.

Wojciechowski S, Tripathi P, Bourdeau T, Acero L, Grimes HL, Katz JD, Finkelman FD, Hildeman DA. Bim/Bcl-2 balance is critical for maintaining naive and memory T cell homeostasis. J Exp Med 2007, 204:1665-1675.

Dr. Hildeman reported in the Journal of Experimental Medicine that the balance between the pro- and anti-apopototic molecules, Bim and Bcl-2, controls the development of T cell memory responses in the context of viral infections. Secondly, they have uncovered a novel mechanism by which T cell responses are regulated. They have found that early activation of a unique T cell population referred to as NKT cells is critical for the optimal generation of T cell responses to viral infection. Understanding how these molecules are regulated will allow for the development of therapies to either augment impaired immune responses or attenuate overzealous immune responses. Dr. Hildeman's outstanding work in this area has resulted in his successful renewal of his RO1 to study these processes.

Mattner J, Savage PB, Leung P, Oertelt SS, Wang V, Trivedi O, Scanlon ST, Pendem K, Teyton L, Hart J, Ridgway WM, Wicker LS, Gershwin ME, Bendelac A. Liver autoimmunity triggered by microbial activation of natural killer T cells. Cell Host Microbe 2008, 3:304-315.

Dr. Mattner, who joined the Division in January of this year, reported in Cell Host Microbe the novel finding that autoimmune liver disease is triggered by an immune response to a specific microbial infection mediated via a unique lipid ligand recognized by NKT cells. Dr. Mattner has already received a grant from the DigestiveHealthCenter here at CCHMC to continue his work in this exciting area.

Division Highlights

The Division of Immunobiology continues to make great strides in fostering collaboration within the immunology community. First, the Cytokine/Mediator Assessment Core is continuing to provide service to

numerous divisions within CCHMC and UCCOM and Universities around the country (Johns Hopkins University, Wright State University, Michigan State University, Dayton Children's Hospital). Secondly, our collaborative efforts have resulted in funding of 13 joint grant proposals with a variety of CCHMC and UC faculty. In addition, we held two highly successful research retreats for the Center for Immunology Research and the Center for Microbial Pathogenesis Center. We organized and facilitated the review and award of 4 pilot projects in Microbial Pathogenesis this year.

Division Collaboration

Collaboration with Allergy & Immunology

Collaborating Faculty: Kimberly Risma, PhD

Dr. Jordan's laboratory explores how cytotoxic function regulates immune responses particularly in the context of the human disorder hemophagocytic lymphohistiocytosis (HLH). HLH, which is a severe inflammatory disorder, has been previously shown to be associated with perforin deficiency. This year, Dr. Jordan in collaboration with Dr. Risma, illustrated, for the first time, the critical role of the C2 domain of the human perforin gene for calcium-dependent, cytotoxic function. Moreover, they identified two amino acid substitutions in the perforin C2 domain in a family with HLH. Improved understanding of the consequences of these mutations may lead to the development of therapies for the treatment of this lethal disorder.

Collaboration with Developmental Biology

Collaborating Faculty: Brian Gebelein, PhD

In collaboration with Dr. Gebelein in Development Biology, Dr. Grimes has shown that Hox-Senseless antagonism forms a molecular switch that integrates neural and anterior-posterior positional information. As the vertebrate senseless homolog is essential for neural development as well as hematopoiesis, we propose Hox-Senseless antagonism will broadly control cell fate decisions (Dev. Cell., 2008)

Collaboration with Molecular Immunology

Collaborating Faculty: Claire Chougnet, PhD

Dr. Hildeman collaborated with Dr. Chougnet in Molecular Immunology to show that regulatory T cell accumulation in aged hosts may underlie their impaired ability to mount immune responses to viral infections. (J. Immunol., 2008).

Collaboration with Experimental Hematology

Collaborating Faculty: Yi Zheng, PhD

Dr. Hildeman in collaboration with Dr. Zheng in Experimental Hematology, has shown that Rac1 and Rac2 have unique roles in common lymphoid progenitor production and share a redundant but essential role in later stages of T-cell development by regulating survival and proliferation signals, Blood, 2008.

Division Publications

1. Finkelman FD. **Anaphylaxis: lessons from mouse models**. *J Allergy Clin Immunol.* 2007; 120: 506-15; quiz 516-7.
2. Finkelman FD. **Use of unrestrained, single-chamber barometric plethysmography to evaluate sensitivity to cholinergic stimulation in mouse models of allergic airway disease**. *J Allergy Clin Immunol.* 2008; 121: 334-5.
3. Finkelman FD, Vercelli D. **Advances in asthma, allergy mechanisms, and genetics in 2006**. *J Allergy Clin Immunol.* 2007; 120: 544-50.
4. Finkelman FD, Wills-Karp M. **Usefulness and optimization of mouse models of allergic airway disease**. *J Allergy Clin Immunol.* 2008; 121: 603-6.
5. Forbes EE, Groschwitz K, Abonia JP, Brandt EB, Cohen E, Blanchard C, Ahrens R, Seidu L, McKenzie A, Strait R, Finkelman FD, Foster PS, Matthaei KI, Rothenberg ME, Hogan SP. **IL-9- and mast cell-mediated intestinal permeability predisposes to oral antigen hypersensitivity**. *J Exp Med.* 2008; 205: 897-913.
6. Herbert DR, Orekov T, Perkins C, Rothenberg ME, Finkelman FD. **IL-4R alpha expression by bone marrow-derived cells is necessary and sufficient for host protection against acute schistosomiasis**. *J Immunol.* 2008; 180: 4948-55.
7. Munitz A, Brandt EB, Mingler M, Finkelman FD, Rothenberg ME. **Distinct roles for IL-13 and IL-4 via IL-13 receptor alpha1 and the type II IL-4 receptor in asthma pathogenesis**. *Proc Natl Acad Sci U S A.* 2008; 105: 7240-5.

8. Phelan JD, Orekov T, Finkelman FD. Cutting edge: mechanism of enhancement of in vivo cytokine effects by anti-cytokine monoclonal antibodies. *J Immunol.* 2008; 180: 44-8.
9. Simons FE, Frew AJ, Ansotegui IJ, Bochner BS, Golden DB, Finkelman FD, Leung DY, Lotvall J, Marone G, Metcalfe DD, Muller U, Rosenwasser LJ, Sampson HA, Schwartz LB, van Hage M, Walls AF. Risk assessment in anaphylaxis: current and future approaches. *J Allergy Clin Immunol.* 2007; 120: S2-24.
10. Simons FE, Frew AJ, Ansotegui IJ, Bochner BS, Golden DB, Finkelman FD, Leung DY, Lotvall J, Marone G, Metcalfe DD, Muller U, Rosenwasser LJ, Sampson HA, Schwartz LB, van Hage M, Walls AF. Practical allergy (PRACTALL) report: risk assessment in anaphylaxis. *Allergy.* 2008; 63: 35-7.
11. Duan Z, Person RE, Lee HH, Huang S, Donadieu J, Badolato R, Grimes HL, Papayannopoulou T, Horwitz MS. Epigenetic regulation of protein-coding and microRNA genes by the Gfi1-interacting tumor suppressor PRDM5. *Mol Cell Biol.* 2007; 27: 6889-902.
12. Wojciechowski S, Tripathi P, Bourdeau T, Acero L, Grimes HL, Katz JD, Finkelman FD, Hildeman DA. Bim/Bcl-2 balance is critical for maintaining naive and memory T cell homeostasis. *J Exp Med.* 2007; 204: 1665-75.
13. Hildeman D, Jorgensen T, Kappler J, Marrack P. Apoptosis and the homeostatic control of immune responses. *Curr Opin Immunol.* 2007; 19: 516-21.
14. Machado FS, Esper L, Dias A, Madan R, Gu Y, Hildeman D, Serhan CN, Karp CL, Aliberti J. Native and aspirin-triggered lipoxins control innate immunity by inducing proteasomal degradation of TRAF6. *J Exp Med.* 2008; 205: 1077-86.
15. Reckling S, Divanovic S, Karp CL, Wojciechowski S, Belkaid Y, Hildeman D. Proapoptotic Bcl-2 family member Bim promotes persistent infection and limits protective immunity. *Infect Immun.* 2008; 76: 1179-85.
16. Zarebski A, Velu CS, Baktula AM, Bourdeau T, Horman SR, Basu S, Bertolone SJ, Horwitz M, Hildeman DA, Trent JO, Grimes HL. Mutations in growth factor independent-1 associated with human neutropenia block murine granulopoiesis through colony stimulating factor-1. *Immunity.* 2008; 28: 370-80.
17. Liu Y, Deng S, Bai L, Freigang S, Mattner J, Teyton L, Bendelac A, Savage PB. Synthesis of diglycosylceramides and evaluation of their iNKT cell stimulatory properties. *Bioorg Med Chem Lett.* 2008; 18: 3052-5.
18. Long X, Deng S, Mattner J, Zang Z, Zhou D, McNary N, Goff RD, Teyton L, Bendelac A, Savage PB. Synthesis and evaluation of stimulatory properties of Sphingomonadaceae glycolipids. *Nat Chem Biol.* 2007; 3: 559-64.
19. Mattner J, Savage PB, Leung P, Oertelt SS, Wang V, Trivedi O, Scanlon ST, Pendem K, Teyton L, Hart J, Ridgway WM, Wicker LS, Gershwin ME, Bendelac A. Liver autoimmunity triggered by microbial activation of natural killer T cells. *Cell Host Microbe.* 2008; 3: 304-15.
20. Pedra JH, Mattner J, Tao J, Kerfoot SM, Davis RJ, Flavell RA, Askenase PW, Yin Z, Fikrig E. c-Jun NH2-terminal kinase 2 inhibits gamma interferon production during Anaplasma phagocytophilum infection. *Infect Immun.* 2008; 76: 308-16.
21. Rocha FJ, Schleicher U, Mattner J, Alber G, Bogdan C. Cytokines, signaling pathways, and effector molecules required for the control of Leishmania (Viannia) braziliensis in mice. *Infect Immun.* 2007; 75: 3823-32.
22. Khodoun M, Lewis CC, Yang JQ, Orekov T, Potter C, Wynn T, Mentink-Kane M, Hershey GK, Wills-Karp M, Finkelman FD. Differences in expression, affinity, and function of soluble (s)IL-4Ralpha and sIL-13Ralpha2 suggest opposite effects on allergic responses. *J Immunol.* 2007; 179: 6429-38.
23. Page K, Lierl KM, Herman N, Wills-Karp M. Differences in susceptibility to German cockroach frass and its associated proteases in induced allergic inflammation in mice. *Respir Res.* 2007; 8: 91.
24. Page K, Lierl KM, Hughes VS, Zhou P, Ledford JR, Wills-Karp M. TLR2-mediated activation of neutrophils in response to German cockroach frass. *J Immunol.* 2008; 180: 6317-24.
25. Wills-Karp M. Complement activation pathways: a bridge between innate and adaptive immune responses in asthma. *Proc Am Thorac Soc.* 2007; 4: 247-51.

Grants, Contracts, and Industry Agreements

Grant and Contract Awards — Annual Direct / Project Period Direct

Grimes, L

Molecular Mechanism of Severe Congenital Neutropenia
National Institutes of Health
R01 HL 079574 — 10/01/05 - 07/31/09 — $237,045 / $976,500

A Molecular Basis for Neuroendocrine Carcinogenesis
National Institutes of Health
R01 CA 112405 — 02/27/06 - 01/31/10 — $155,502 / $640,584

The Molecular Basis of Acute Myeloid Leukemia
The Leukemia and Lymphoma Society
10/01/05 - 06/30/10 $105,000 / $498,751

Molecular Control of Lung Adenocarcinoma Initiating Cells
UCCC
UCCC-Grimes 07/01/08 - 06/30/09 $40,000 / $40,000

Hildeman, D

Self-Assembling Biomaterials Constructed from Native Peptides
National Institutes of Health (University of Chicago)
R21 DE 017703 09/01/07 - 07/31/08 $8,444 / $8,444

Transforming Growth Factor Beta in T-Cell Homeostasis and Tolerance
National Institutes of Health (Arizona Board of Regents)
R01 AI 067903 03/01/07 - 02/28/11 $20,485 / $83,592

Horman, S

Targeting Cancer Stem Cells
Cancer Free Kids
07/01/07 - 06/30/08 $20,000 / $20,000

Jordan, M

Immune System Evasion by Cancer
Cancer Free Kids
07/01/07 - 06/30/08 $20,000 / $20,000

Immune Regulation in Hemophagocytic Lymphohistiocytosis
US Immunodeficiency Network
N01 AI 30070 09/01/06 - 08/31/08 $100,000 / $200,000

An Animal Model of Hemophagocytic Lymphohistiocytosis
National Institutes of Health
R01 AI 091769 08/10/07 - 06/30/12 $250,000 / $1,250,000

Lewkowich, I

The Role of Regulatory T Cell and Dedritic Cell Interactions in Susceptibility to Allergic Asthma
American Lung Association
07/01/06 - 06/30/08 $32,500 / $65,000

Mattner, J

Sphinogomonas Breaks Peripheral Tolerance Due to NKT Cell Activation
Lupus Research Institute
LRI-Mattner, Jochen 01/01/08 - 10/31/09 $86,440 / $186,440

Digestive Health Center - Bench to Bedside Research in Pediatric Digestive Disease
National Institutes of Health
P30 DK 078392 06/01/08 - 05/31/09 $25,000 / $25,000

Wills-Karp, M

Immune Dysregulation in Autism
National Alliance for Autism Research
07/01/06 - 06/30/08 $50,000 / $100,000

Interleukin-13 In Experimental Asthma
National Institutes of Health
P01 HL 076383 07/01/04 - 06/30/09 $1,354,297 / $7,008,574

Wills-Karp, M	Component 1	278,182
Finkelman, F	Component 2	273,182
Rothenberg, M	Component 3	273,182
Hershey, G	Component 4	273,181

Witte, C	Scientific Core 1	95,789
Rothenberg, M	Scientific Core 2	109,971
Wills-Karp, M	Administrative Core	55,810

Asthma Positional Candidate Genes in Mice and Humans
National Institutes of Health
R01 HL 067736 — 12/01/05 - 11/30/10 — $242,750 / $1,250,000

Mechanisms of Particulate Matter-Induced Allergic Asthma
National Institutes of Health (Johns Hopkins University)
P50 ES 015903 — 09/29/07 - 06/30/12 — $223,125 / $1,121,320

Epithelial Genes in Allergic Inflammation
National Institutes of Health
U19 AI 070235 — 09/15/06 - 08/31/11 — $190,620 / $190,620

Center for Childhood Asthma in Urban Environment
US Environmental Protection Agency (Johns Hopkins University)
RD 83213901 — 11/01/04 - 10/31/08 — $60,344 / $247,184

Center for Childhood Asthma in Urban Environment
National Institutes of Health (Johns Hopkins University)
P01 ES 009606 — 05/07/04 - 10/31/08 — $45,815 / $287,850

Current Year Direct **$3,267,367**

Industry Contracts

Wills-Karp, M

Allertein Therapeutics	$ 31,390

Current Year Direct Receipts **$31,390**

Funded Collaborative Efforts

Wills-Karp, M.

Role of Cockroach Proteases in Airway Inflammation
National Institutes of Health
Page, K — 12/01/04 - 11/30/09 — 1 %

Biology of IL-13 Receptor Alpha 2
National Institutes of Health
Hershey, G — 01/01/04 - 12/31/08 — 1 %

Complement in Allergic Asthma: The Role of C3a and C5a
National Institutes of Health
Koehl, J — 07/01/04 - 06/30/09 — 1 %

Grimes, H.L.

Genetic Screen for Pathways Cooperating with AML1-ETO
Ohio Cancer Research Associates
Mulloy, J — 07/01/06 - 06/30/08 — 1 %

Hildeman, D.

Oncolytic HSV Therapy in Immunocompetent Sarcoma Models
National Institutes of Health
Cripe, T — 07/06/06 - 05/30/11 — 10 %

Role of Immunoproteasomes in Activated T Cell Apoptosis
National Institutes of Health
Griffin, T — 09/20/07 - 08/31/09 — 5 %

CD40 Ligand Dysregulation and HIV Pathogenesis
National Institutes of Health
Chougnet, C — 01/01/05 - 12/31/09 — 7 %

Jordan, M.

Pathophysiologic Basis of Perforin Misfolding in Cytotox
American Academy of Allergy, Asthma & Immunology
Risma, K 07/01/07 - 06/30/09 2.5 %

Total $3,298,757

Immunobiology Graduate Program

The Immunobiology Graduate Program is an inter-departmental program within the University of Cincinnati that offers PhD and MS degrees in Immunology. The Division of Immunobiology serves as the administrative home of the Graduate Program. The program is governed by the director Dr. Wills-Karp and Associate Director Dr. Christopher Karp and a Steering Committee composed of members of several departments/divisions at CCHMC and UC. Dr. Jonathan Katz is the coordinator of the Foundations in Immunology Courses.

The Immunobiology Program provides broadly based instruction in immunology, along with rigorous research training that emphasizes modern approaches to understanding the function of the immune system in health and disease. To this end, the program currently has 45 faculty members from 4 departments and 12 divisions within the College of Medicine and CCHMC. Since its inception in 2003, we have enrolled 25 outstanding students from around the country and abroad. Milestones achieved this year include the graduation of our first student and the successful completion of the written qualifier by all of the first year students. Our students have distinguished themselves already by receiving several travel and research awards (AAAI, Keystone Symposium, XXI International Complement Workshop).

The Program is supported financially by a variety of sources. This year, tuition support was provided through University Graduate Scholarships awarded by the University of Cincinnati. Student stipends were supported through a variety of sources including funds from the University of Cincinnati (UGA), NIH training grants, external grants to their advisors, and funds from Cincinnati Children's Research Foundation. The program anticipates sustained growth over the next few years with a target class size of 10 new students per year.

Immunobiology Graduate Program Students, 2007-2008

Student	Faculty Mentor	Admission Year
Jessica Allen	Christopher Karp	2004
Adora Lin	David Hildeman	2004
Vanessa Saunders	Marsha Wills-Karp	2004
Leah Kottyan	Nives Zimmermann	2005
Xun Zhang	Joerg Koehl	2005
Erin Zoller	Michael Jordan	2005
Katherine Groschwitz	Simon Hogan	2005
Erin Klenk	Robert Colbert	2006
James Phelan	H. Leighton Grimes	2006
Manuel Alvarez	Sherry Thornton	2006
Jill Fritz	Timothy Weaver	2006
Joni Ullman	Jay Degen	2006
Amanda Beichler	Simon Hogan	2007
Cortez McBerry	Julio Aliberti	2007
Rachael Mintz	Suzanne Wells	2007
Sema Kurtulus	David Hildeman	2007
Ibrahim Aksoylar	Kasper Hoebe	2007

Student Honors

- **Jessica Allen** Supported by NIH Bioterrorism Training Grant
- **Jill Fritz** Supported by Cardiovascular and Pulmonary Training Grant

- **Katherine Groschwitz** Received ST*AR Travel Award from AAAAI, and Keystone Symposia Scholarship; "Mast Cell-Mediated Intestinal Permeability," National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK)
- **Leah Kottyan** Received ST*AR Travel Award from AAAAI, Outstanding Trainee Award from International Eosinophil Society meeting and P.E.O Scholar Award (PEO is a philanthropic organization that provides competitive, merit-based awards for women of the United States and Canada who are either pursuing a doctoral level degree or engaged in postgraduate study or research at an accredited college or university).
- **Cortez McBerry** Received Yates Scholarship Award
- **Vanessa Saunders** Received ST*AR Travel Award from AAAAI, Travel Award from American Thoracic Society, UC Conference Travel Award for Autumn Immunology Conference, Preparing Future Faculty Program
- **Xun Zhang** Received Trainee Award from the XXI International Complement Workshop

Publications (2007-08)

1. Tuner MJ, ML DeLay, S Bai, E Klenk, and RA Colbert. **HLA-B27 up-regulation causes accumulation of misfolded heavy chains and correlates with the magnitude of the unfolded protein response in transgenic rats: Implications for the pathogenesis of spondylarthritis-like disease.** *Arthritis Rheum.* 56(1):215-223. 2007.
2. Zhang X, J Clark, G Köhl, M Wills-Karp and J Köhl. **Opposing roles for C5aR- and C3aR signaling in the development of maladaptive immunity in allergic asthma.** *Mol Immunol.* 44(16):3912. 2007.
3. Phelan JD, T Orekov, and F Finkelman. **Cutting edge: Mechanism of enhancement of in vivo cytokine effects by anti-cytokine monoclonal antibodies.** *J Immunol.* 180(1):44-8. 2008.
4. Smith JA, MJ Turner, ML DeLay, EI Klenk, DP Sowders, and RA Colbert. **Endoplasmic reticulum stress and the unfolded protein response are linked to synergistic IFN-beta induction via X-box binding protein 1.** *Eur J Immunol,* 38(5):1194-1203. 2008.

Abstracts

1. Saunders V, I Lewkowich., N Herman, K Dienger, J Clark, P Breysse and M Wills-Karp. **"Ambient Particulate Matter Exposure Results in Recruitment and Activation Myeloid Dendritic Cells in the Murine Lung."** *American Thoracic Society,* May, 2008
2. Zoller E, J Lykens, L Filipovich and M Jordan. **Systemic activation of macrophages by interferon gamma causes consumptive cytopenias and hemophagocytosis.** *Experimental Biology* 2008, April 2008. San Diego CA.
3. Saunders VC, B Sakthivel, CC Lewis, K Dienger, P Breysse, B Aronow and M Wills-Karp. **"Ambient Particulate Matter Induced Epithelial Cell Gene Changes in Susceptible versus Resistant Mouse Strains".** *American Academy of Allergy Asthma and Immunology* March, 2008
4. Klenk EI and RA Colbert. **The role of the unfolded protein response (UPR) in IL-23 regulation.** *36th Annual Autumn Immunology Conference,* November, 2007. Chicago IL
5. Allen JL, R Madan, DJ Rawlings, FD Finkelman and CL Karp. **Regulation of TLR4 signaling by RP105 in B cells.** *36th Annual Autumn Immunology Conference,* November, 2007. Chicago IL
6. Saunders VC, B Sakthivel, CC Lewis, K Dienger, P Breysse, B Aronow, M Wills-Karp. **"Ambient Particulate Matter Induced Epithelial Cell Gene Changes in Susceptible and Resistant Mouse Strains".** *36th Annual Autumn Immunology Conference,* November 2007, Chicago IL
7. Zoller E, J Lykens, L Filipovich and M Jordan. **Systemic activation of macrophages by interferon gamma causes hemophagocytosis and consumptive anemias.** *36th Annual Autumn Immunology Conference,* November 2007. Chicago IL.
8. Lin A, S Wojciechowski, M Jordan and D Hildeman. **"Sex differences in immune cell recruitment and cytokine production after intracranial LCMV infection."** *Organization for the Study of Sex Differences Annual Meeting,* May 9-12, 2007. Washington, DC
9. Kottyan, LC, AR Collier, KA Niese, CO Radu, ON Witte, ME Rothenberg and N Zimmermann. **The T-cell Death Associated Gene-8 (TDAG8) is an acid-sensing eosinophil receptor that critically regulates airway eosinophilia.** *International Eosinophil Conference,* Snowbird Utah, 2007.