

CURRICULUM VITAE

Nita H. Salzman MD, PhD

**Director, Professor
Department of Pediatrics
Division of Gastroenterology**

OFFICE ADDRESS:

Medical Education Building
8701 Watertown Plank Rd
Milwaukee, WI 53226

EDUCATION:

09/1979 - 06/1983 BA - Chemistry, Bryn Mawr College, Bryn Mawr, PA
08/1983 - 06/1990 MD, New York University School of Medicine, New York, NY
08/1983 - 06/1987 MS, New York University School of Medicine, Sackler Institute of Biomedical Sciences,
New York, NY
08/1983 - 06/1990 PhD, New York University School of Medicine, New York, NY

POSTGRADUATE TRAINING AND FELLOWSHIP APPOINTMENTS:

06/1990 - 06/1997 Resident, Pathology and Laboratory Medicine, Hospital of the University of Pennsylvania,
Philadelphia, PA
07/1994 - 06/1996 Postdoctoral Fellowship, Division of Human Genetics and Molecular Biology, Children's
Hospital of Philadelphia, Philadelphia, PA
07/1996 - 06/1997 Post doctoral Fellowship, Department of Microbiology, University of Pennsylvania School
of Medicine, Philadelphia, PA

FACULTY APPOINTMENTS:

06/1990 - 06/1997 Assistant Instructor, Department of Pathology and Laboratory Medicine, University of
Pennsylvania School of Medicine, Philadelphia, PA
07/1997 - 06/2001 Research Assistant Professor, Department of Microbiology, University of Pennsylvania
School of Medicine, Philadelphia, PA
08/2001 - 06/2009 Assistant Professor, Department of Pediatrics, Division of Gastroenterology, Medical
College of Wisconsin, Milwaukee, WI
08/2004 - Present Secondary Appointment, Department of Microbiology and Molecular Genetics, Medical
College of Wisconsin, Milwaukee, WI
07/2009 - 06/2014 Associate Professor, Pediatrics, Gastroenterology, Medical College of Wisconsin,
Milwaukee, WI
07/2014 - Present Professor, Pediatrics, Gastroenterology, Medical College of Wisconsin, Milwaukee, WI

ADMINISTRATIVE APPOINTMENTS:

07/2005 - Present Director, GI Clinical Laboratory, Department of Pediatrics, Division of Gastroenterology,
Medical College of Wisconsin, Milwaukee, WI
01/01/2013 - Present co-Leader, Immunology, Inflammation and Infection Research Unit, Children's
Research Institute, Children's Hospital of Wisconsin, Milwaukee, WI
01/01/2014 - Present Associate Director, Medical Scientist Training Program, Medical College of Wisconsin,
Milwaukee, WI
01/01/2016 - Present Director of Research, Pediatrics, Gastroenterology, Medical College of Wisconsin,
Milwaukee, WI
07/01/2016 - Present Scientific Director, Gnotobiotic mouse facility, Medical College of Wisconsin,
Milwaukee, WI

07/01/2016 - Present Director, Center for Microbiome Research, Medical College of Wisconsin, Milwaukee, WI

SPECIALTY BOARDS AND CERTIFICATION:

| <u>Board Certified</u> | <u>Issue Date</u> | <u>Expiration</u> |
|--|-------------------|-------------------|
| American Board of Pathology, Anatomic Pathology | 06/1994 | None |

| <u>Licensure</u> | <u>Number</u> | <u>Issue Date</u> | <u>Expiration</u> |
|-------------------------|---------------|-------------------|-------------------|
| Pennsylvania (inactive) | 049744 L | 1994 | None |
| Wisconsin | 49506-020 | 07/2006 | None |

AWARDS AND HONORS:

1983 Sigma Xi Scientific Honor Society
1996 - 1998 Fellowship , Crohn's and Colitis Foundation of America
2016 Women Pioneer in Research Award, Medical College of Wisconsin

MEMBERSHIPS IN HONORARY AND PROFESSIONAL SOCIETIES:

09/12/2017 - Present Medical College of Wisconsin Society for Research Excellence (member)
American Gastroenterological Association (Member)
American Association for the Advancement of Science (Member)
American Society for Microbiology (Member)
Society for Pediatric Research (Member)

EDITORSHIPS/EDITORIAL BOARDS/JOURNAL REVIEWS:

Editorial Board
2011 - Present Infection and Immunity
2016 - Present Gut Microbes
02/01/2021 - Present Gut Microbes
Journal Review
2003 - Present Microbiology
2003 - Present Anaerobe
2003 - Present Journal of Dairy Science
2004 - Present Infection and Immunity, Applied and Environmental
2004 - Present Trends in Microbiology
2005 - Present Pediatrics
2007 - Present Gastroenterology
2008 - Present J. Immunology
2008 - Present Microbes and Infection
2010 - Present Cell Host & Microbe
2010 - Present Proceedings of the National Academy of Sciences
2011 - Present Cellular Microbiology
2011 - Present Science
2012 - Present Nature Immunology
2014 - Present PLOS Pathogens
2014 - Present Nature
2014 - Present Molecular Cell
2016 - Present Science Translational Medicine
2016 - Present Nature Microbiology
2019 - Present mSphere
2020 - Present Immunity

NATIONAL ELECTED/APPOINTED LEADERSHIP AND COMMITTEE POSITIONS:

2003 - 2011 Ad Hoc Reviewer, Crohn's and Colitis Foundation of America

2005 - 2007 Member, CSR Special Emphasis Panel, ZRG1 F07-L (20) Immunology Fellowships and AREA grants, NIH Study Section

2005 - 2008 Member, Microbiology Focus Group-Crohn's and Colitis Foundation of America

2010 Reviewer, National Institute on Aging, program project review, NIH Study Section

2010 Reviewer, Review of "Enteric Research Investigational Network Cooperative Research Centers (ERIN) Cooperative Research Centers (CRCs), NIH Study Section

2011 - 2018 member, Research Training Grant Review Committee, Crohn's and Colitis Foundation of America

2011 Reviewer, Targeting existence in Select Gram Negative Pathogens (R21/R33) Special Emphasis Panel, NIH NIAID

2011 Reviewer, NIDDK Hepatobiliary Pathophysiology Study Section, NIH

2011 Reviewer, CAREER proposal review, NSF

2011 Vice Chair Elect, Gordon Research Conference on Antimicrobial

2012 - 2102 Reviewer, Dynamics of Host Associated Microbial Communities Special Emphasis Panel, NIH NIGMS

2012 - 2102 Reviewer, Ancillary Studies to Ongoing Clinical Studies in Areas of Interest to NIDDK, NIH NIDDK

2013 Reviewer, Dynamics of Host Associated Microbial Communities Special Emphasis Panel, NIH NIGMS

2013 Chair, Gordon Research Conference on Antimicrobial Peptides

2013 Reviewer, Pilot and Feasibility Clinical Research Studies in Digestive Diseases and Nutrition Study Section, NIH NIDDK

2013 Reviewer, Liver and Gastrointestinal Physiology, Pathology and Pharmacology Study Section, NIH NIDDK

2013 - 2016 Ad Hoc Reviewer, Gastrointestinal Mucosal Pathobiology Study Section, NIH NIDDK

2014 - 2017 Member, Scientific Advisory Board of the Broad Medical Research Foundation, Crohn's and Colitis Foundation of America

2016 Reviewer, Exploratory Studies for Delineating Microbiome: Host Interactions in Obesity, Digestive and Liver Diseases and Nutrition (R21) Special Emphasis Panel, NIH NIDDK

2016 - 2020 Member, Gastrointestinal Mucosal Pathobiology Study Section, NIH NIDDK

2018 - 2020 vice-Chair, Research Training Award Review Committee, Crohn's and Colitis Foundation

2018 - Present Member, National Advisory Committee, Crohn's and Colitis Foundation

2018 Editorial Review Panel Member, NIH Director's New Innovator Award Program (DP2), NIH

2020 Chair, Gastrointestinal Mucosal Pathobiology Study Section, NIH NIDDK

2020 Reviewer, New Innovators Awards (DP2) Special Emphasis Panel, NIH NIAID

2021 - Present Chair, Digestive System Host Defense, Microbial Interactions and Immune and Inflammatory Diseases (DHMI) Study Section, NIH

RESEARCH GRANTS/AWARDS/CONTRACTS/PROJECTS:

Active

Peer Review

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|---------------|--|
| Title: | Gastroenterology Postdoctoral Research Training Grant T32 |
| Source: | NIH NIDDK |
| Role: | co-PI |
| PI: | Salzman/Shaker |
| Dates: | 07/01/2015 - 06/30/2021 |
| Title: | Intestinal Enterococcal Dynamics: Modeling Host-Commensal and Host-Pathogen Interactions |
| Source: | NIH NIGMS |
| Role: | PI |
| PI: | Salzman |
| Dates: | 2017 - 2022 |
| Direct Funds: | \$366,000 (per year) |

Title: Investigating the role of the microbiome and inflammation in acute and chronic pain in patients with sickle cell disease
Source: NIH NHLBI
Role: Investigator
PI: Brandow
Dates: 07/2018 - 06/2023
Direct Funds: \$499,999 (per year)

Title: Impact of L. plantarum 299v Supplementation on Endothelial Function and Systemic Inflammation
Source: NIH NHLBI
Role: Investigator
PI: Widlansky
Dates: 04/01/2019 - 01/31/2023
Direct Funds: \$600,000 (per year)

Title: Reducing innate inflammation in new onset T1D with Lactobacillus plantarum
Source: NIH/NIDDK
Role: Investigator
PI: Hessner
Dates: 01/01/2021 - 05/31/2025
Direct Funds: \$593,943 (per year)

Title: Inflammatory crosstalk between skin and gut
Source: NIH/NIDDK
Role: Principal Investigator (MPI)
PI: Salzman/Gallo (UCSD)
Dates: 03/01/2021 - 02/28/2025
Direct Funds: \$447,842 (per year)

Title: Blockade of IL-23 for the Prevention of Graft Versus Host Disease
Source: NIH/NHLBI
Role: Investigator
PI: Drobyski
Dates: 05/01/2021 - 03/31/2025
Direct Funds: \$14,999,966 (total)

Non-Peer Review

Title: The human holobiont: Enhancing health and preventing disease
Source: Advancing a Healthier Wisconsin Research and Education Program
Role: Principal Investigator (MPI)
PI: Salzman/Williams
Dates: 07/01/2021 - 06/30/2026
Direct Funds: \$500,000 (per year)

Prior

Peer Review

Title: Human Defensin 5 and Intestinal Colonization

Source: NIH, NIAID, K08 Clinical Investigator Award
Role: Principal Investigator
PI: Salzman
Dates: 04/01/1998 - 03/31/2002
Direct Funds: \$256,200 (per year)

Title: The Role of Human Enteric Defensins in Mucosal Immunity
Source: NIH, Center for Molecular Studies in Digestive and Liver Disease (P30DK50306)
Role: Principal Investigator
PI: Salzman
Dates: 07/01/1998 - 06/30/2000
Direct Funds: \$30,000

Title: Regulation of Enteric Antimicrobial Peptides by Salmonella Typhimurium
Source: University of Pennsylvania Research Foundation Award
Role: Principal Investigator
PI: Salzman
Dates: 03/01/2001 - 07/01/2001
Direct Funds: \$20,000

Title: In vivo Models of Defensin Activity
Source: NIH, consortium sub to Dr. Charles Bevins, UC Davis
Role: Co-investigator
PI: Bevins
Dates: 02/01/2002 - 01/31/2007
Direct Funds: \$250,000

Title: The Regulation of Paneth Cell Antimicrobial Peptides by S. typhimurium
Source: Children's Hospital of Wisconsin Foundation
Role: Principal Investigator
PI: Salzman
Dates: 07/01/2002 - 06/30/2005
Direct Funds: \$40,000 (per year)

Title: In Vitro Systems to Study Human Paneth Cell Defensin Function
Source: Digestive Disease Center of the Medical College of Wisconsin
Role: Principal Investigator
PI: Salzman
Dates: 10/01/2002 - 09/30/2004
Direct Funds: \$15,000

Title: The Regulation of Paneth Cell Defensins by Bacterial Infection
Source: NIH, R21
Role: Principal Investigator

PI: Salzman
 Dates: 09/30/2004 - 05/31/2005
 Direct Funds: \$225,000

Title: The Regulation of Paneth Cell Defensins
 by Bacterial Infection
 Source: NIH, R01
 Role: Principal Investigator
 PI: Salzman
 Dates: 06/01/2005 - 02/28/2010
 Direct Funds: \$225,000 (per year)

Title: SIGIRR, a Negative Regulator of Toll-
 IL-1R Signaling
 Source: NIH, subcontract to Dr. Xiaoxia Li,
 Cleveland Clinic Foundation
 Role: Co-investigator
 PI: Li
 Dates: 06/15/2005 - 02/28/2010
 Direct Funds: \$50,000 (per year)

Title: Lactobacillus GG for the Treatment of
 Minimal Hepatic Encephalopathy
 Source: NIH/NCCAM
 Role: Co-Investigator
 PI: Bajaj
 Dates: 09/01/2009 - 08/31/2012
 Direct Funds: \$50,000 (per year)

Title: The impact of loperamide on the
 pathogenesis of Salmonella enteritis in
 mice
 Source: McNeil Pharmaceuticals
 Role: Principal Investigator
 PI: Salzman
 Dates: 11/01/2009 - 10/31/2010
 Direct Funds: \$100,000

Title: The Intestinal Microbiome in the
 Development of Pediatric NAFLD
 Source: MCW, DDC/CTSI
 Role: Principal Investigator
 PI: Salzman
 Dates: 01/31/2010 - 01/30/2011
 Direct Funds: \$100,000

Title: The Intestinal Microbiome in the
 Development of Pediatric NAFLD
 Source: AAP Resident Research Grant
 Role: mentor (for Dr. Brittany Goldberg, 2nd
 year Pediatrics resident)
 Dates: 07/01/2010 - 06/30/2011
 Direct Funds: \$3,000 ((\$2000 for supplies and \$1000
 for travel))

Title: The Intestinal Microbiome in Pediatric
 NAFLD-sample collection pilot

Source: NIH/NIDDK
Role: Principal Investigator
PI: Salzman
Dates: 10/01/2010 - 09/30/2011
Direct Funds: \$236,000

Title: Biospecimen Collection and Analysis:
Metagenomic Assessment of the
Microbiome

Source: NCS
Role: Co-Investigator
Dates: 11/01/2010 - 10/31/2011
Direct Funds: \$130,000

Title: Paneth Cells, the Microbiome, and
Crohn's Disease Susceptibility

Source: CCFA Microbiome Initiative
Role: Principal Investigator
PI: Salzman
Dates: 01/01/2011 - 12/31/2014
Direct Funds: \$300,000 (per year)

Title: The intestinal bacterial metagenome in
pediatric NAFLD

Source: NIH/NIDDK R01
Role: Principal Investigator
PI: Salzman
Dates: 12/01/2011 - 11/30/2016
Direct Funds: \$998,000 (per year)

Title: Bacterial-host dynamics at the intestinal
mucosal interface

Source: NIH/NIGMS, R01
Role: Principal Investigator
PI: Salzman
Dates: 12/01/2011 - 11/30/2016
Direct Funds: \$250,000 (per year)

Title: The Role of the Microbiome in Chronic
Visceral Hypersensitivity

Source: Mead Johnson Nutrition
Role: co-PI
Dates: 02/16/2012 - 02/15/2014

Title: Enterococcus niche formation in the GI
tract

Source: NIH NIAID
Role: co-PI
PI: Salzman/Kristich
Dates: 07/01/2012 - 06/30/2015
Direct Funds: \$275,000 (total)

Title: Changes in BMI and Intestinal
Microbiota with Prebiotics, Probiotics
and Synbiotics

Source: CTSI
Role: co-PI

PI: Salzman/Frenn
Dates: 08/01/2012 - 07/31/2013

Title: Establishing mechanistically validated targets and lead molecules for microbiome-based therapy in IBD

Source: Crohn's and Colitis Foundation of America

Role: Investigator
PI: Braun
Dates: 03/01/2014 - 02/28/2018
Direct Funds: \$45,000

Title: Lactic Acid Bacteria that Detect and Inhibit Enterococci in the Mammalian GI Tract

Source: NIH/NIGMS subcontract from the University of Minnesota

Role: co-PI
PI: Salzman/Dunny/Kaznessis
Dates: 08/01/2014 - 05/31/2018
Direct Funds: \$100,000 (per year)

Title: Bacteriophage to prevent infection by antibiotic-resistant enterococci

Source: NIH NIAID
Role: Investigator
PI: Kristich
Dates: 12/01/2015 - 11/31/2018
Direct Funds: \$275,000 (total for two years)

Title: Microbial approaches for the treatment of multi-drug resistant enterococci

Source: Advancing a Healthier Wisconsin
Role: PI
PI: Salzman
Dates: 01/01/2016 - 12/31/2017
Direct Funds: \$200,000 (total)

Title: Modulation of Gut-Brain Axis Using Fecal Microbiome Transplant Capsules in Cirrhosis

Source: NIH NCATS subcontract from Virginia Commonwealth University

Role: Investigator
PI: Bajaj
Dates: 04/15/2017 - 01/31/2019
Direct Funds: \$63,000

Non-Peer Review

Title: The Role of Enteric Defensins in Mucosal Immunity

Source: Medical College of Wisconsin
Role: Principal Investigator
PI: Salzman
Dates: 08/15/2001 - 06/30/2004
Direct Funds: \$255,000

INVITED LECTURES/WORKSHOPS/PRESENTATIONS:

Local

- Human Defensin 5 Transgenic Mice: An In Vivo Model of Defensin Function, Children's Hospital of Wisconsin, Department of Pediatrics, Milwaukee, WI, 2002
- The Role of Enteric Defensins in Mucosal Immunity, MCW Digestive Disease Center Research Seminar, Milwaukee, WI, 2002
- Human Defensin 5 Transgenic Mice: An In Vivo Model of Defensin Function, MCW Department of Microbiology and Molecular Genetics, Milwaukee, WI, 2002
- The Role of Defensins in Mucosal Protection of the Gastrointestinal Tract, MCW Digestive Disease Center Advisory Board, Milwaukee, WI, 2002
- Enteric Defensins and the Regulation of the Intestinal Microbiota, MCW Department of Microbiology and Molecular Genetics, Milwaukee, WI, 2003
- Defending the GI tract: the role of defensins in host-microbe interactions, Children's Hospital of Wisconsin, Department of Pediatrics, Milwaukee, WI, 2005
- The Role of Defensins in Innate Mucosal Immunity, MCW Department of Microbiology and Molecular Genetics, Milwaukee, WI, 2007
- Innate Mucosal Immunity and the Microbial Ecology of the GI Tract, Medical College of Wisconsin, Department of Medicine, Division of Infectious Diseases, Milwaukee, WI, 2007
- The GI microbiota, mucosal immunity, and the "Microflora Hypothesis" of allergic disease, Department of Pediatrics, Division of Allergy and Immunology, Children's Hospital of Wisconsin, Milwaukee, WI, 2008
- Go with your gut: the intestinal microbiome in health and disease, Children's Research Institute, Children's Hospital of Wisconsin, Milwaukee, WI, 2008
- Studies of the intestinal microbiome: Applicability to basic and translational research, Department of Pediatrics, Division of Gastroenterology, Milwaukee, WI, 2008
- Innate Immune Regulation of Intestinal Microbial Ecology, 2008 Pediatric Research Symposium, Children's Research Institute, Children's Hospital of Wisconsin, Milwaukee, WI, 2008
- A niche of one's own: Bacteria-biome-mucosal immune interactions, Medical College of Wisconsin, Department of Medicine, Division of Infectious Diseases, Milwaukee, WI, 2010
- Impact of the immune system on the microbiome, Children's Research Institute, Children's Hospital of Wisconsin, Milwaukee, WI, 2010
- Medical College of Wisconsin Microbiome Project, IBD Family Forum, Children's Hospital of Wisconsin, Milwaukee, WI, 2011
- The role of the intestinal microbiome in immunology and allergic disease, Department of Pediatrics, Division of Allergy and Immunology, Children's Hospital of Wisconsin, Milwaukee, WI, 2011
- Paneth cells, the microbiome and intestinal homeostasis: Implications for the development of Crohn's disease, Children's Research Institute Seminar, Children's Hospital of Wisconsin, Milwaukee, WI, 2012
- Paneth cells, antimicrobial peptides, and the microbiota: Détente at mucosal surfaces, Department of Pediatrics, Division of Allergy and Immunology, Children's Hospital of Wisconsin, Milwaukee, WI, 2012
- Paneth cells, antimicrobial peptides, and the regulation of intestinal homeostasis, Department of Pediatric Surgery, Medical College of Wisconsin, Milwaukee, WI, 2014
- Enterococcus faecalis dynamics in the gut: finding and defending your niche, Division of Infectious Diseases, Department of Medicine, Medical College of Wisconsin, Milwaukee, WI, 2014
- Enterococcus faecalis niche formation in the GI tract: at least two sides to the story, Division of Hematology and Oncology, Department of Medicine, Medical College of Wisconsin, Milwaukee, WI, 2014
- Paneth cells, antimicrobial peptides, and the regulation of intestinal homeostasis, CTSI, Medical College of Wisconsin, Milwaukee, WI, 2014
- Paneth cells, the microbiome, and Crohn's disease, Digestive Disease Center Advisory Board Meeting, Medical College of Wisconsin, Milwaukee, WI, 2015
- Obtaining grant funding: Persistence Pays!, Department of Pediatrics K Club, Medical College of Wisconsin, Milwaukee, WI, 2015
- The Microbiome, the Immune System and Intestinal Homeostasis: A Delicate Balance, Department of Pediatrics, Children's Hospital of Wisconsin, Children's Research Institute Seminar, Milwaukee, WI,

2015

- Microbial Niche Competition in the GI Tract, Department of Cell Biology, Neurobiology and Anatomy, Medical College of Wisconsin, Milwaukee, WI, 2015
- Good Bugs, Bad Bugs, the Microbiome and You, "It's contagious: inside the world of infectious disease", Conversations with Scientists. Advancing a Healthier Wisconsin, Medical College of Wisconsin, Milwaukee, WI, 2016
- Characterizing and Targeting the Microbiome in Human Disease, Children's Research Institute Golden Angels Meeting, Milwaukee, WI, 2016
- The microbiome and allergy, Division of Allergy and Immunology, Department of Pediatrics, Children's Hospital of Wisconsin, Milwaukee, WI, 2016
- The Microbiome, the Immune System and Intestinal Homeostasis: A Delicate Balance, Children's Hospital of Wisconsin Board Meeting, Medical College of Wisconsin, Milwaukee, WI, 2016
- The Microbiome in Health and Disease, 10th Annual Diabetes Symposium of Wisconsin, Milwaukee, WI, 2017
- Creating and defending your niche: antimicrobial production and resistance, UW Microbiology Club, Milwaukee, WI, 2017
- Antimicrobial peptides and intestinal homeostasis: Contributions of both host and microbe, Department of Obstetrics and Gynecology Research Seminar, Medical College of Wisconsin, Milwaukee, WI, 2018
- The microbiome in health and disease, Milwaukee Academy of Medicine, Milwaukee, WI, 2018
- A role for the microbiome in pediatric NAFLD, Children's Research Institute Seminar, Children's Hospital of Wisconsin, Medical College of Wisconsin, Milwaukee, WI, 2018
- Therapeutic bacteria to prevent multidrug-resistant enterococcal infections, First Look Forum Event: What's Brewing in MKE?, Milwaukee, WI, 2018
- A role for the microbiome in pediatric NAFLD, Inaugural Dean's Hour seminar series, Medical College of Wisconsin, Milwaukee, WI, 2019
- A role for the microbiome in pediatric NAFLD, Pediatric GI divisional meeting, Medical College of Wisconsin, Milwaukee, WI, 2019
- The intestinal microbiome in pediatric NAFLD, Children's Research Institute Seminar Series, Children's Hospital of Wisconsin, Milwaukee, WI, 2020

Regional

- The Role of Enteric Defensins in Innate Mucosal Host Defense, Department of Nutritional Sciences, College of Agricultural and Life Sciences, University of Wisconsin-Madison, Madison, WI, 2003
- The Role of Enteric Defensins in Innate Mucosal Immunity, Ripon College, Ripon, WI, 2004
- The Role of Intestinal Defensins in Innate Mucosal Immunity, 11th Annual Midwest Microbial Pathogenesis Conference, Lansing, MI, 2004
- Paneth cells, the microbiome and intestinal homeostasis: Implications for the development of Crohn's disease, Concordia University, School of Pharmacy, Mequon, WI, 2012
- Paneth cells, the microbiome and IBD, CCFA Patient and Family Education Program, Illinois chapter of the CCFA, Palatine, IL, 2015
- Two sides to intestinal homeostasis: roles for both host and microbial antimicrobial peptides, 9th Annual Center for Human Immunology Symposium: The Impact of the Microbiome on Immunity, Blood Research Institute, Wauwatosa, WI, 2015
- Characterizing and Targeting the Microbiome in Human Disease, BioForward Wisconsin Speaker Series: Introducing the Microbiome, Milwaukee, WI, 2016
- Antimicrobial peptides: Mediators of intestinal colonization, homeostasis and defense, Department of Nutritional Sciences, College of Agricultural and Life Sciences, University of Wisconsin-Madison, Madison, WI, 2017

National

- Innate Intestinal Host Defense: The Role of Defensins in the Small, UMDNJ, Jonty Foundation/The Autism Center Think Tank Conference, Somerset, NJ, 2003
- Analysis of 16S Libraries of Mouse Intestinal Bacteria: "The Real Story of Enteric Flora", IBD Research-Junior Faculty Symposium, Chicago, IL, 2003
- The Role of Enteric Defensins in Innate Mucosal Immunity, Cleveland Clinic Foundation, Cleveland, OH, 2004
- The Role of Enteric Defensins in Innate Mucosal Immunity, California State University, Los Angeles, CA,

2005

- Innate Mucosal Immunity and the Microbial Ecology of the GI Tract, Department of Microbiology-Immunology, Northwestern University Feinberg School of Medicine, Chicago, IL, 2007
- Innate Mucosal Immunity and the Microbial Ecology of the GI Tract, Department of Microbiology and Immunology, University of California Davis School of Medicine, Davis, CA, 2008
- Discussion Leader, Antimicrobial Peptides Gordon Research Conference, Ventura, CA, 2009
- Session Moderator, Digestive Disease Week, Chicago, IL, 2009
- Session Moderator, Digestive Disease Week, New Orleans, LA, 2010
- The Intestinal Microbiome: Regulation, Perturbation, and Susceptibility to Salmonella Infection, Colloquium entitled "Pathogen modulation of the normal microbiota", American Society for Microbiology 110th General Meeting, San Diego, CA, 2010
- Paneth cells, antimicrobial peptides, and maintenance of intestinal homeostasis, Cincinnati Children's Hospital, Cincinnati, OH, 2011
- Paneth cells, defensins, and the regulation of the intestinal microbiota, PAS/ASPR, Denver, CO, 2011
- Paneth cells: Host defense and the gut microbiome, The NIH Center for Molecular Studies in Digestive and Liver Diseases Penn/CHOP 13th Annual Symposium, "IBD, Functional Genomics and the Intestinal Mucosal Interface", Philadelphia, PA, 2012
- Intestinal Host-Microbial Interactions: Implications for Host Immunity, NIA Advisory Committee Meeting on the Microbiome and Aging, Bethesda, MD, 2012
- Bacterial-host dynamics at the intestinal mucosal interface, University of Minnesota, Minneapolis, MN, 2013
- Bacterial-host dynamics at the intestinal mucosal interface, Dynamics of Host-Associated Microbial Communities, NIH, NIGMS, Bethesda, MD, 2013
- Paneth cells, antimicrobial peptides, and the regulation of intestinal homeostasis, New Jersey Medical School, Newark, NJ, 2014
- Paneth cells, antimicrobial peptides, and the regulation of intestinal homeostasis, Microbiology Seminar Series, Alumnae Day speaker, University of Pennsylvania School of Medicine, Philadelphia, PA, 2014
- Paneth cells, antimicrobial peptides, and the regulation of intestinal homeostasis, Case Western Reserve University School of Medicine, Department of Pathology, Cleveland, OH, 2014
- Paneth cells, antimicrobial peptides, and the regulation of intestinal homeostasis, Albert Einstein College of Medicine, Department of Pediatrics, Bronx, NY, 2015
- Paneth cells, the microbiome, and Crohn's disease susceptibility, University of Nebraska Medical Center, Omaha, NE, 2015
- Assessment of the effects of microbiome composition in pediatric NAFLD., 2015 Annual Meeting of the American Society for Human Genetics, Session: Genetic Control of the Microbiome, Baltimore, MD, 2015
- Paneth cell dysfunction, dysbiosis, and Crohn's disease, Experimental Biology 2015, Boston, MA, 2015
- The Microbiome, the Immune System and Intestinal Homeostasis: A Delicate Balance, Association for Molecular Pathology AMP2015 Annual Meeting, Austin, Texas, 2015
- The CCFA Microbiome Project, CCFA Gala, Northern California Chapter, San Francisco, CA, 2015
- Paneth cells, antimicrobial peptides, and the regulation of intestinal homeostasis, University of North Carolina, Chapel Hill, NC, 2015
- The Microbiome, the Immune System and Intestinal Homeostasis: A Delicate Balance, Stanley Manne Children's Research Institute, Feinberg School of Medicine, Northwestern University, Chicago, IL, 2016
- Antimicrobial peptides shape intestinal niche creation and competition, NIH workshop, The Human Microbiome: Emerging Themes at the Horizon of the 21st Century, Bethesda, MD, 2017
- Genetics, Environment and the Microbiome: Implications for Human Health and Disease, DOHaD Society Meeting, Chapel Hill, NC, 2018
- Antimicrobial peptides and intestinal homeostasis: Contributions of both host and microbe, University of Iowa Carver College of Medicine, Iowa City, IA, 2018
- Antimicrobial peptides and intestinal homeostasis: Contributions of both host and microbe, Vanderbilt University School of Medicine, Nashville, TN, 2018
- Antimicrobial Peptides: Mediators of Bacterial Niche Competition in the GI Tract, University of Washington, Seattle, WA, 2018
- Enterococcus colonization and competition in the GI tract, Tri-I Immunology and Microbial Pathogenesis Program Research Seminar Series, Sloan Kettering Institute, Rockefeller University, Weill Cornell Medical College, New York, NY, 2018

Antimicrobial peptides and intestinal homeostasis: Contributions of both host and microbe, University of Toledo College of Medicine, Toledo, OH, 2018

Paneth Cells in Host Defense and Homeostasis. State-of-the-art lecture., Digestive Disease Week (DDW) 2018, Washington, DC, 2018

Antimicrobial peptides and bacterial niche competition in the GI tract, Department of Molecular Genetics & Microbiology Symposium entitled “Harnessing Immunity to Combat Infection and Disease”, Renaissance School of Medicine at Stony Brook University, Stony Brook, NY, 2019

Enterococcus colonization and competition in the GI tract, Department of Microbiology, University of Pennsylvania School of Medicine, Philadelphia, PA, 2019

Antimicrobial peptides and intestinal homeostasis: Contributions of both host and microbe., Department of Biology, Bryn Mawr College, Bryn Mawr, PA, 2019

Antimicrobial peptides and intestinal homeostasis: Contributions of both host and microbe, Spring Lecture Series on Cellular Homeostasis 2019, University of Southern California, Los Angeles, CA, 2019

The intestinal microbiome in pediatric NAFLD, North American Society for Pediatric Gastroenterology, Hepatology and Nutrition (NASPGHAN), virtual, 2020

N.H. Salzman, The intestinal microbiome in Pediatric NAFLD, Digestive Disease Research Center Seminar, Vanderbilt University School of Medicine, virtual, 2021

The intestinal microbiome and host protection from enterococcus infection, Digestive Disease Week, virtual, 2021

International

The Impact of Enteric Defensins on the Intestinal Microbiota, The Impact of Enteric Defensins, Barga, Italy, 2003

The role of enteric defensins in innate mucosal immunity, SBARIS, Tokyo, Japan, 2004

Intestinal Commensals and Innate Immunity, Innate Immunity and its Modulation in Inflammatory Bowel Disease, Stuttgart, Germany, 2005

Discussion Leader, Antimicrobial Peptides Gordon Research Conference, Barga, Italy, 2007

The Commensal Microbiota: From Homeostasis to Disease, A Peter Wall Institute for Advanced Studies and College de France Symposium, Paris, France, 2011

Defensins as Essential Regulators of Intestinal Microbial Ecology, Antimicrobial Peptides Gordon Conference, Barga, Italy, 2011

Antimicrobial peptides and the regulation of the intestinal microbiota, International Workshop on Intestinal Mucosal Homeostasis and Disease, Hannover, Germany, 2011

Paneth cells, antimicrobial peptides, and maintenance of intestinal homeostasis, University of Alberta, Edmonton, Alberta, Canada, 2012

Paneth cell defensins and intestinal homeostasis: host regulation of the microbiota, PWSE (Pancosma) meeting, Madrid, Spain, 2012

Antimicrobial Peptides and the Regulation of the Intestinal Microbiome: Implications for Intestinal Homeostasis, International Probiotics Association World Congress, Los Angeles, CA, 2012

Antimicrobial peptides from host and microbe contribute to intestinal homeostasis, Antimicrobial Peptides Gordon Conference, Barga, Italy, 2015

Niche competition in the gastrointestinal tract, Wenner-Gren Symposium on Host-Microbe Interaction in the Gut-From Model Systems to Human Disease, Stockholm, Sweden, 2016

Antimicrobial peptides and bacterial niche competition in the GI tract, Zing Conference on Antimicrobial Activity and Defense Strategies at the Mucosal Surface, Albufeira, Portugal, 2016

Two sides to intestinal homeostasis: Roles for both host and microbial AMPs, Keynote Speaker, AMP2016, Montpellier, France, 2016

Microbiome-based therapeutics to eliminate intestinal colonization by multidrug-resistant bacteria, 27th ECCMID (European Congress of Clinical Microbiology and Infectious Diseases), Vienna, Austria, 2017

Antimicrobial peptides and bacterial niche competition in the GI tract, Cold Spring Harbor Asia Conference on Bacterial Infection and Host Defense, Suzhou, China, 2017

PEER REVIEWED WORKSHOPS/PRESENTATIONS:

Local

Jennings K, Chakraborty R, Kristich C, Salzman N., Mononuclear phagocytes respond to ceftriaxone-induced

Enterococcus faecalis dissemination, 11th Annual Immunology Scientific Retreat, MCW, Milwaukee, WI, 2020

Regional

- Regulation of the Intestinal Microbiota by Paneth Cell Defensins, Digestive Disease Week, AGA, Poster of Distinction, Chicago, IL, 2005
- Reduced Paneth cell alpha-defensin expression in Crohn's Disease of the ileum, Digestive Disease Week, AGA, Poster of Distinction, Chicago, IL, 2005
- Banla, I.L., M. Hayward, N.H. Salzman and C.J. Kristich, Stable and long-term colonization of the murine GI tract by *E. faecalis* is dependent on *ireK*, Midwest Microbial Pathogenesis Conference, Indianapolis, IN, 2015
- Chakraborty, R., J. Stromich, M. Hayward, T. Nelson, C.J. Kristich, and N.H. Salzman, The role of the innate immune system in systemic enterococcus dissemination and clearance, Midwest Microbial Pathogenesis Conference, Indianapolis, IN, 2015
- Banla I, Kommineni S, Hayward M, Kristich C, Salzman N., Contributions of Enterococcus faecalis Cell Surface Proteins to Intestinal Colonization, 9th Annual Immunology Conference, Blood Research Institute, Milwaukee, WI, 2017
- Chakraborty R, Stromich J, Bretl D, Hayward M, Kristich C, Salzman N., Role of the Innate Immune System in Systemic Enterococcus Dissemination and Clearance, 9th Annual Immunology Conference, Blood Research Institute, Milwaukee, WI, 2017
- Chakraborty R, Lam V, Kommineni S, Stromich J, Hayward M, Kristich C, Salzman N., Ceftriaxone-mediated dynamics between the host, microbiota and enterococci in mouse gastrointestinal tract., 12th Annual Immunology Conference, Blood Research Institute (Versiti), Milwaukee, WI, 2019

National

- Increased Enteric Defensin Expression in Necrotizing Enterocolitis, Society for Pediatric Research, Annual Meeting, Washington, DC, 1996
- Oral Infection with *S. typhimurium* Causes Down-regulation of Enteric Antimicrobial Peptide Expression, Keystone Symposia on Molecular and Cellular Biology. Innate and Acquired Immunity at Mucosal Surfaces, Taos, NM, 2000
- Human Defensin 5 Transgenic Mice: An In Vivo Model of Defensin Function, Digestive Disease Week, AGA, Distinguished Plenary Presentation, San Francisco, CA, 2002
- Enteric Defensins are Essential Regulators of Intestinal Microbial Ecology, SPR Research Conference, 2007
- Enteric Defensins are Essential Regulators of Intestinal Microbial Ecology, ASM Conference on Beneficial Microbes, San Diego, CA, 2008
- Kommineni, S., M. Hayward, P. Bousounis, C. J. Kristich, and N.H. Salzman, Factors associated with Enterococcus faecalis colonization in the GI tract, 2013 Molecular Genetics of Bacteria and Phages Conference, Madison, WI, 2013
- Gurram, B., Stephens, M., V. Lam, M. Hayward, P. Bousounis, U. Broeckel, E. Worthey, P. Simpson, and N.H. Salzman, Paneth Cells, the Microbiome, and Crohn's Disease Susceptibility, IBD Advances Meeting, Hollywood, FL, 2013
- Liu, T.C., N.H. Salzman, C.A. Arnold, and T.S. Stappenbeck, Evolution of Paneth Cell Phenotype in Crohn's Disease: Implications for Disease Etiopathogenesis, Digestive Disease Week, Chicago, IL, 2014
- Kommineni, S., M. Hayward, P. Bousounis, C. J. Kristich, and N.H. Salzman, The Bacteriocin-21 confers a competitive advantage for *E. faecalis* intestinal colonization through competition, conjugation, and microbiome manipulation, ASM Conference on Beneficial Microbes, Washington, DC, 2014
- Simpson P, Pan A (Cao Y), Huang B, Johnson J, Schwimmer J, Holtz M, Weinstock G, Weinstock E, Salzman N., For the microbiome, zeroes are definitely of non-zero importance, Joint Statistical Meetings, Chicago, IL, 2016
- Banla, I., M. Hayward, N.H. Salzman and C.J. Kristich, Determinants of Enterococcus faecalis cell envelope integrity and antimicrobial resistance modulate intestinal colonization in mice, 2016 Molecular Genetics of Bacteria and Phages Conference, Madison, WI, 2016
- Schwimmer JB, Newton KP, Africa J, Durelle J, Arroyo S, Bross C, Behling C, Hamilton G, Sirlin CB, Borecki I, Mitreva M, Tyagi R, Belt P, Yates KP, Lavine JL, Johnson J, Sodergren E, Weinstock G, Holtz M, Simpson P, Salzman N., The intestinal microbiome in children with nonalcoholic fatty liver disease: A case-control study., Digestive Disease Week, San Diego, CA, 2016
- Jennings KC, Banla I, Kristich C, Salzman NH, Growth phase and osmotic stress drive subcellular

localization of Enterococcus faecalis OGIRF_11271, a conserved protein involved in cell envelope integrity., Molecular Genetics of Bacteria and Phages Meeting, Madison, WI, 2019

International

- Inhibition of Paneth Cell Antimicrobial Peptide Expression Following Salmonella Infection Requires SPII Type III Secretion, Antimicrobial Peptides Gordon Conference, Ventura, CA, 2001
- Regulation of the Intestinal Microbiota by Paneth Cell Defensins, Antimicrobial Peptide Gordon Conference, Ventura, CA, 2005
- Enteric Defensins are Essential Regulators of Intestinal Microbial, Antimicrobial Peptides Gordon Conference, Barga, Italy, 2007
- Chakraborty, R. J. Stromich, D. Bretl, M. Hayward, C. Kristich, and N.H. Salzman, Enterococcus faecalis dynamics in the gastrointestinal tract: Interaction between antibiotics, microbiota and antimicrobial peptides, Gordon Research Conference on Antimicrobial Peptides, Ventura, CA, 2013
- Kommineni, S., M. Hayward, Bretl, D., P. Bousounis, C. J. Kristich, and N.H. Salzman, Factors associated with bacteriocin encoding plasmid dependent Enterococcus faecalis colonization in the GI tract, Gordon Research Conference on Antimicrobial Peptides, Ventura, CA, 2013
- Liu, T. C., B. Gurram, V. Lam, M. Baldrige, R. Head, M. Stephens, D. Lerner, M. Hayward, P. Bousounis, M. Holtz, Y. Cao, P. Simpson, H. Virgin, T. Stappenbeck and N. H. Salzman, Paneth cells, the microbiome, and Crohn's disease susceptibility, Antimicrobial Peptides Gordon Conference, Barga, Italy, 2015
- Kommineni, S., D. Bretl, V. Lam, R. Chakraborty, M. Hayward, P. Bousounis, C. J. Kristich and N. H. Salzman, Bacteriocin production augments niche competition by enterococci in the mammalian GI tract, Antimicrobial Peptides Gordon Conference, Barga, Italy, 2015

COMMITTEE SERVICE:

Medical College of Wisconsin

- 2004 Member, Basic Science Innovation Task Force, Department of Pediatrics, Medical College of Wisconsin
- 07/2005 - 06/2008 Member, Institutional Animal Care and Use Committee, Medical College of Wisconsin
- 2005 - 2006 Member, Task Force on Conflict of Interest, Department of Pediatrics, Medical College of Wisconsin
- 2006 Member, Biophotonic Core Oversight Committee, Medical College of Wisconsin
- 2006 Member, "Advancing a Healthier Wisconsin" Scientific Peer Review Panel, Medical College of Wisconsin
- 2006 Chair, DDC grant review committee, Medical College of Wisconsin
- 2010 Member, DDC grant review committee
- 2011 - 2014 Member, Faculty Career Development Committee, Medical College of Wisconsin
- 2013 - Present Member, Internal NIH grant review committee, Department of Pediatrics
- 2016 Member, Bioinformatics Faculty Advisory Group
- 2019 - Present Member, University Rank and Tenure Committee

MEDICAL COLLEGE TEACHING ACTIVITIES:

Medical Student Education

- 2001 - 2008 Lab Instructor, Microbiology
- 2011 New Curriculum Development
- 2013 - 2018 Instructor, GI and Nutrition Unit
- 2017 - Present Lecturer, Infectious Agents and Host Immunity (IAHI)

Graduate Student Education

- 2009 - Present Instructor, Mucosal Pathogenesis
- 2010 - Present Instructor, Mucosal Immunology
- 2014 - 2019 Instructor, Cellular and Molecular Immunology
- 2017 - Present Instructor, Translational Genetics
- 2017 - 2019 Instructor, Cellular Microbiology
- 2019 - Present Instructor, Integrated Curriculum

MCW STUDENTS, FACULTY, RESIDENTS AND CLINICAL/RESEARCH FELLOWS MENTORED:

Undergraduate Students

Miranda Lyles, MCW, 2021 CTSI 500 Stars Summer Internship

Graduate Students

PhD Students Advised

Sritejasvinithi Karimikonda, MCW, 2021 - Present

PROGRAMMATIC DEVELOPMENTS:

Research Programs

2016 - Present Center for Microbiome Research

BIBLIOGRAPHY

Refereed Journal Publications/Original Papers

1. Haribhai D, Williams JB, Jia S, Nickerson D, Schmitt EG, Edwards B, Ziegelbauer J, Yassai M, Li SH, Relland LM, Wise PM, Chen A, Zheng YQ, Simpson PM, Gorski J, Salzman NH, Hessner MJ, Chatila TA, Williams CB. A requisite role for induced regulatory T cells in tolerance based on expanding antigen receptor diversity. *Immunity*. 2011 Jul 22;35(1):109-22. PMID: PMC3295638
2. Zimmerman, N.P., Vongsa, R.A., Faherty, S.L., SALZMAN, N.H., and M.B. Dwinell. Targeted intestinal epithelial deletion of the chemokine receptor CXCR4 reveals important roles for extracellular-regulated kinase-1/2 in restitution. *Lab Invest*. Epub 2011 May 2. PMID: 21537329
3. Duerr, C.U., N.H. SALZMAN, A. Dupont, A. Szabo, B.H. Normark, S. Normark, R.M. Locksley, P. Mellroth, and M.W. Hornef. Control of intestinal Nod2-mediated peptidoglycan recognition by epithelium-associated lymphocytes. *Mucosal Immunology*, 2010, (27 October 2010) doi:10.1038/mi.2010.71.
4. Biswas, A., Y. Liu, L. Hao, A. Mizoguchi, N.H. SALZMAN, C.L. Bevins, and K.S. Kobayashi. Induction and rescue of Nod2-dependent Th1-driven granulomatous inflammation of the ileum. *Proc. Natl. Acad. Sci.* 2010, 107(33): 14739-14744. PMID: 20679225
5. SALZMAN, N.H., K. Hung, D. Haribhai, H. Chu, J. Karlsson-Sjoberg, E. Amir, P. Tegatz, M. Barman, M. Hayward, D. Eastwood, M. Stoel, Y. Zhou, E. Sodergren, G.M. Weinstock, C.L. Bevins, C.B. Williams, and N.A. Bos. Enteric defensins are essential regulators of intestinal microbial ecology. *Nature Immunology*, 2010, 11(1): 76-83. published online 22 October 2009; doi:10.1038/ni.1825. PMID: 19855381
6. Crosswell, A., E. Amir, P. Tegatz, M. Barman, and N.H. SALZMAN. Prolonged Impact of Antibiotics on Intestinal Microbial Ecology and Susceptibility to Enteric Salmonella Infection. *Infection and Immunity*, 2009, 77(7):2741-53. PMID: PMC2708550
7. Haribhai, D., Lin, W., Edwards, B., Ziegelbauer, J., SALZMAN, N.H., Carlson, M.R., Li, S-H., Simpson, P.M., Chatila, T.A., and C. B. Williams. A Central Role for Induced Regulatory T Cells in Tolerance Induction in Experimental Colitis. *J. Immunol.* 2009, 182(6): 3461-8.
8. Underwood, M.A., SALZMAN, N.H., Bennett, S.H., Barman, M., Mills, D.A., Marcobal, A., Tancredi, D.J., Bevins, C.L., and M.P. Sherman. A Randomized Placebo-controlled Comparison of Two Prebiotic/Probiotic Combinations in Preterm Infants: Impact on Weight Gain, Intestinal Microbiota, and Fecal Short Chain Fatty Acids. *J. Pediatr. Gastroenterol. Nutr.* 2009 48(2):216-225.
9. Pechous, R.D., McCarthy, T.R., Mohapatra, N.P., Soni, S., Penoske, R.M., SALZMAN, N.H., Frank, D.W., Gunn, J.S., and T.C. Zahrt. A Francisella tularensis Schu S4 Purine Auxotroph is Highly Attenuated in Mice but Offers Limited Protection Against Homologous Intranasal Challenge. *PLoS ONE* 2008 Jun 25; 3(6); e2487.
10. Barman, M., D. Unold, K. Shifely, E. Amir, K. Hung, N. A. Bos, and N.H. SALZMAN. Enteric Salmonellosis Disrupts the Microbial Ecology of the Murine Gastrointestinal Tract. *Infection and Immunity*, 2008: 76(3): 907-915.

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12. Wehkamp, J., N. H. SALZMAN, E. Porter, M. Weichenthal, R. E. Petras, B. Shen, E. Schaeffeler, M. Schwab, R. Linzmeier, R. W. Feathers, H. Chu, H. Lima, K. Fellermann, T. Ganz, E. F. Stange, and C. L. Bevins. Reduced Paneth cell α -defensin expression in Crohn's Disease of the ileum. *Proc. Natl. Acad. Sci.* 2005; 102 (50): 18129-18134.
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18. SALZMAN, N.H., E. B. Mallow, A. Harris, J.P. Russell, R.J. DeBerardinis, E. Ruchelli, and C.L. Bevins. 1996. Human enteric defensins: Gene structure and developmental expression. *J. Biol. Chem.* 271(8): 4038-4045.
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20. SALZMAN, N.H., and F.R. Maxfield. 1988. Intracellular fusion of sequentially formed endocytic compartments. *J. Cell Biol.* 106:1083-1091.
21. Cais, R.E., J.M. Kometani, and N.H. SALZMAN, 1986. NMR characterization of the chemical microstructure of vinylidene halide and vinyl halide copolymers. *Macromolecules* 19: 1006-1012.
22. Cais, R.E., J.M. Kometani, and N.H. SALZMAN, 1983. Analysis of the chemical microstructure of copolymers by high-resolution nuclear magnetic resonance spectroscopy. *Analytical Proceedings* 20: 579-582.
23. Bevins CL, Salzman NH. The potter's wheel: the host's role in sculpting its microbiota. *Cell Mol Life Sci.* 2011 Nov;68(22):3675-85. PMID: PMC3222938
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- Human α -defensin 6 promotes mucosal innate immunity through self-assembled peptide nanonets. *Science*. 2012 Jul 27;337(6093):477-81. PMID: PMC4332406
32. Bretl DJ, He H, Demetriadou C, White MJ, Penoske RM, Salzman NH, Zahrt TC. MprA and DosR coregulate a *Mycobacterium tuberculosis* virulence operon encoding Rv1813c and Rv1812c. *Infect Immun*. 2012 Sep;80(9):3018-33. PMID: PMC3418728
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