BIOGRAPHICAL SKETCH

NAME **Harry Greenberg**	POSITION TITLE Professor of Medicine, Microbiology/Immunology
eRA COMMONS USER NAME (credential, e.g., agency login) GREENBERG.HARRY	

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	MM/YY	FIELD OF STUDY
Dartmouth College, Hanover, NH	B.A.	1966	Medicine
Columbia College of Physicians & Surgeons, New York, NY	M.D.	1970	Medicine
Stanford Univ. School of Medicine, Stanford, CA	Fellowship	1972-74	Medicine (GI Div.)

A. Personal Statement

Over the past 40 years, I have focused my research interests on viral infections of the liver, GI tract and respiratory tree. My studies have tended to be of viruses associated with substantial morbidity and/or mortality in both developed and less developed countries and have ranged from basic studies of innate and acquired immunity and viral pathogenesis in animal models to more translational investigations of vaccine efficacy and viral serology in humans. More specifically, in recent years we have begun to study the role of innate immune mechanisms, type 1 interferon and dendritic cells on rotavirus and influenza pathogenesis and acquired immune responses. Additional recent studies have focused on using novel assays to study the B cell response to influenza vaccination.

B. Positions and Honors

Positions and Employment

1972-1974 Research Associate, USPHS, NIAID, LID, NIH, Bethesda, MD
1976-1983 Medical Officer, USPHS, NIAID, LID, NIH, Bethesda, MD
1983-1989 Associate Professor of Medicine and Microbiology and Immunology, Stanford University School of Medicine, Stanford, CA
1988-1998 Chief, Division of Gastroenterology, Stanford University School of Medicine, Stanford, CA
1989- Professor of Medicine and Microbiology and Immunology, Stanford University School of Medicine, Stanford, CA
1991-1997 Medical Investigator, VA Palo Alto Health Care System, Palo Alto, CA
1996 Acting Chairman, Department of Medicine, Stanford University School of Medicine
1997-2000 Associate Chief of Staff for Research, VA Palo Alto Health Care System, Palo Alto, CA
1999-2000 Senior Associate Dean for Research, Stanford University School of Medicine, Stanford, CA
2000-2002 Vice President for Research, Medimmune, Mountain View, CA (LOA, Stanford University)
2002- Senior Associate Dean for Research, Stanford University School of Medicine, Stanford, CA
2002- Staff Physician, Gastroenterology Service, VA Palo Alto Health Care System Palo Alto, CA
2005-2006 Acting Co-Chairman, Department of Medicine, Stanford University School of Medicine

Other Experience and Professional Memberships

1980 American Society of Clinical Investigation
1992 Association of American Physicians
1991-1997 VA Medical Investigator Award
1994-2004 NIH Merit Award (R37)
2003- Fellow, American Association for the Advancement of Science (AAAS)
2008-2009 President, American Society of Virology
2009- Fellow, American Academy of Microbiology

2011- Co-chair, NIAID, NIH Board of Scientific Counselors

C. Selected Recent Peer-reviewed Publications **(selected from over 400 publications)**

1. Fenaux M, Cuadras MA, Feng N, Jaimes M, & Greenberg HB. Extra-Intestinal spread and replication of homologous (EC) and Heterologous (RRV) rotavirus in BALB/c Mice. J Virology,80(11):5219-32, 2006.
2. Feng N, Jaimes MC, Lazarus NH, Monak D, Zhang C, Butcher EC and Greenberg HB. Redundant Role of Chemokines CCL25/TECK and CL28/MEC in IgA Plasmablast Recruitment to the Intestinal Lamina Propria after Rotavirus Infection. J Immunol, 176:5749-59, 2006. PMID: 16670280
3. Feng N, Sen A, Nguyen H, Vo P, Hoshino Y, Deal EM, Greenberg HB. Variation in antagonism of the interferon response to rotavirus NSP1 results in differential infectivity in mouse embryonic fibroblasts. J Virol. 83 (14): 6987-94, 2009. PMCID: PMC2704795.
4. Sen A, Feng N, Ettayebi K, Hardy ME, Greenberg HB. IRF3 Inhibition by Rotavirus NSP1 is Host cell and Viral Strain Dependent but Independent of NSP1 Proteasomal Degradation. J Virol. 83 (20); 10322-10335, 2009. PMCID: PMC2753142.
5. Wolf MM, Vo PT, Greenberg HB. Rhesus Rotavirus entry into a polarized epithelium is endocytosis dependent and involves sequential VP4 conformational changes. J.Virol. 85 (6): 2492-2503. 2011.
6. Feng N, Sen A, Wolf M, Vo P, Hoshino Y, Greenberg HB. Roles of VP4 and NSP1 in determining the distinctive replication capacities of simian rotavirus RRV and bovine rotavirus UK in the mouse biliary tract. J. Virol. 85 (6): 2686-2694. 2011.
7. Sen A, Dermody T, Garcia-Sastre A, Greenberg H. The early interferon response to rotavirus is regulated by PKR and is dependent on MAVS/IPS-1, RIG-I, MDA-5, and IRF3. J.Virol. 85 (8): 3717-32. 2011.
8. Sasaki S, Sullivan M, Narvaez CF, Holmes T, Furman D, Zheng N-Y, James J, Smith K, Nishtala M, CL, Davis MM, Wilson PC, Greenberg HB, and He X-S. Limited efficacy of inactivated influenza vaccine in elderly individuals is associated with decreased production of vaccine-specific antibodies. J Clin Invest. 121 (8): 3109-3119. 2011.
9. Narvaez CF, Feng N, Vasquez C, Sen A, Angel J, Greenberg HB, Franco MA. Human rotavirus specific IgM memory B cells have differential cloning efficiency and switch capacity and play a role in antiviral immunity in vivo. J. Virol. 86 (19): 10829-40, 2012.
10. Sen, A., Rothenberg, M.E., Mukherjee, G., Feng, N., Nair, N., Kalisky, T., Johnstone, I. M., Clarke, M. F., and Greenberg, H. B. Innate immune response to homologous rotavirus infection in the small intestinal villous epithelium at single-cell resolution. PNAS Early Edition. Online 12/2012.

Additional recent publications of importance to the field (in chronological order)

1. Youngman KR, Franco MA, Kuklin NA, Rott LS, Butcher EC, Greenberg HB. Correlation of tissue distribution, developmental phenotype, and intestinal homing receptor expression of antigen-specific B cells during the murine anti-rotavirus immune response. J Immunol, 168:2173-81, 2002. PMID: 11859103
2. Cuadras MA, Greenberg HB. Rotavirus infectious particles use lipid rafts during replication for transport to the cell surface in vitro and in vivo.Virology, 313 (1): 308-21, 2003.
3. He X-S, Draghi M, Mahmood K, Holmes TH, Kemble GW, Dekker CL, Arvin AM, Parham P, and Greenberg HB. T cell-dependent production of IFN-g by natural killer cells in response to influenza A virus. J Clin Invest, 114(12):1812-19, 2004.
4. Jaimes, M., N. Feng, and H. Greenberg. 2005. Characterization of homologous and heterologous rotavirus specific T cell responses in infant and adult mice. J Virology, 79:4568-4579, 2005.
5. Aoki ST, Settembre E, Trask DS, Greenberg HB, Harrison SC, Dormitzer PR. Structure of rotavirus outer-layer protein VP7 bound with a neutralizing Fab. Science 324 (5933): 1444-7, 2009. (PMCID: Pending)
6. Narvaez CF, Franco MA, Angel J, Morton JM, Greenberg HB. Rotavirus differentially infects and polyclonally stimulates human B cells depending on their differentiation state and tissue of origin. J. Virol. 84 (9): 4543-4555, 2010. PMCID: PMC2863723.
7. Deal EM, Jaimes MC, Crawford SE, Estes MK, Greenberg HB. Rotavirus structural proteins and dsRNA are required for the human primary plasmacytoid dendritic cell IFNα response. Plos Pathogens. Jun 3;6(6):e1000931, 2010. PMCID: PMC2880586.

8. Wolf M, Deal E, Greenberg H. Rhesus Rotavirus trafficking during entry into MA104 cells is restricted to the early endosome compartment. J. Virol. 86 (7): 409-413, 2012.
9. Xiao-Song H, Sasaki S, Baer J, Khurana, S, Golding H, Treanor J, Topham D, Sangster M, Jin H, Dekker C, Subbarao K, Greenberg H. Heterovariant cross-reactive B-cell responses induced by the 2009 pandemic influenza A/H1N1 vaccine. JID. (Epub ahead of print) Oct 29, 2012.
10. Jiang N, He J, Weinstein JA, Penland L, Sasaki S, He X-S, Dekker C, Zheng N, Huang M, Sullivan M, Wilson PC, Greenberg HB, Davis MM, Fisher DS, and Quake SR. High throughput sequencing of the human antibody repertoire in response to influenza vaccination. Science Translational Medicine. In Press. 2012.

D. Research Support

Ongoing Research Support

R01 AI021362 Greenberg (PI) 2/15/10 – 1/31/15
NIH/NIAID
Viral Gastroenteritis: Basis of Protection and Virulence
Role: Principal Investigator
The specific aims are 1) Define, at the individual immunoglobulin level, the serological nature and structural basis of heterotypic humoral rotavirus immunity in humans. 2) Identify RV genes responsible for variation between strains in their ability to replicate systemically and cause systemic disease and characterize the link between interferon (IFN) interference and cellular tropism in vivo. 3) Characterize the interaction of murine plasmacytoid dendritic cells (pDCs) with rotavirus and determine the contribution of pDC-derived interferon to restricting RV infection as well as B cell activation.

U19 AI057229 Davis (PI) 4/1/09 – 3/31/13
NIH/NIAID
Protective Mechanisms against Pandemic Respiratory Virus
The major goal of this project is to use vaccine-induced and naturally acquired influenza A immunity as a model for comprehensive, integrated analyses of adaptive and innate immune mechanisms and antimicrobial protection of the respiratory tract in children and adults. The primary goal of Project 1 is to study B cell immunity to influenza.
Role: Co-Investigator and Project 1 leader

UL1 RR025744 Greenberg (PI) 5/19/08 – 4/30/13
NIH/NCRR
Stanford Center for Clinical & Translational Education and Research (Spectrum)
This is a trans-institutional CTSA to transform clinical and translational research and education at Stanford. It consists of 12 separate programs, each focused on ensuring that basic discoveries get translated into improvements in human health and well being.
Role: Principal Investigator

GRH0022 Greenberg (PI) 7/1/10 – 6/30/14
VA Merit Review Award
Studies of Intestinal Tropism, Viral Entry and Rescue
This merit review proposal seeks to examine three separate but related components of the rotavirus-host interaction: 1) intestinal tropism, 2) virus entry, and 3) viral rescue.
Role: Principal Investigator

PATH Greenberg (PI) 3/1/05 – 12/31/12
Program for Appropriate Technology in Health
INDO-US Collaboration to Develop Rotavirus Vaccines
The major goal of this project is to develop an Indian rotavirus vaccine in India.
Role: Principal Investigator

U19 AI090019 Greenberg (PI); Butcher (Co-PI) 7/12/10 – 6/30/15
NIH/NIAID
Vaccination and Infection: Indicators of Immunological Health and Responsiveness. Project 1. Plasmablast Trafficking and Antibody Response in Influenza Vaccination
Our goal is to develop and apply assays to characterize the human immune response to influenza vaccination, both seasonal and H1N1, and to compare responses to mucosal vs. systemic vaccination. We will use markers of proliferation and activation to define plasmablasts specifically induced by the immunization, and to determine whether they are targeted by patterns of trafficking receptor expression that would allow their access to pulmonary sites of reinfection. In addition, polyclonal Abs made by blood B blasts will be studied to characterize the affinity, isotype and homotypic and heterosubtypic specificity of anti-flu PAbs made by responding cells in response to the vaccines.
Role: Principal Investigator

CCHI Discretionary Fund Greenberg (PI) 5/1/2012 – 4/30/2013
NIH/Cooperative Centers for Translational Research on Human Immunology and Biodefense (CCHI)
Innate immune responses to influenza virus in single human nasal epithelial cell
The goal of this study is to investigate the innate immune transcriptional responses in primary human nasal epithelial cells to influenza virus and vaccine.
Role: Principal Investigator

HIPC Infrastructure & Opportunities Fund Greenberg (PI) 7/1/2012 – 6/30/2013
NIH/Human Immunology Project Consortium (HIPC)
The human mucosal immune responses to influenza virus: a systems biology approach
This study uses a systems biology strategy to investigate the innate and adaptive mucosal immune responses to influenza virus in human upper respiratory tract.
Role: Principal Investigator

Bench to Bedside Program Subbarao/Greenberg (PI) 7/1/2012 – 6/30/2013
NIH/NIAID
Transcriptional responses to LAIV in bulk and single resident URT cells
This study investigates the in vivo transcriptional responses to various wild type or live attenuated influenza viruses in human URT.
Role: Extramural Investigator