CURRICULUM VITAE

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Contact Information

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Education

1975-1979	B.A.	University of Virginia Charlottesville, Virginia Major: Biochemistry
1984-1991	Ph.D.	University of Maryland School of Medicine Department of Microbiology & Immunology Center for Vaccine Development Division of Geographic Medicine

Employment History

Academic Appointments

1993-2004	Research Assistant Professor Center for Vaccine Development Division of Geographic Medicine University of Maryland School of Medicine
2004-2013	Associate Professor of Medicine Center for Vaccine Development Division of Geographic Medicine University of Maryland School of Medicine
2013-present	Professor of Medicine Center for Vaccine Development Division of Geographic Medicine University of Maryland School of Medicine

Other Employment - Industry

1979-1982	Technician

Bethesda Research Laboratories (Rockville, MD)

1983-1991 Research Assistant (Associate Staff)
Center for Vaccine Development
University of Maryland School of Medicine

1991-1993 MedImmune, Inc.
35 West Watkins Mill Road
Gaithersburg, MD 20878

Professional Society Memberships

1990-Present American Society for Microbiology (National chapter)

2003 American Chemical Society

Honors and Awards

Research Award

Total Award: $50,000

Towards a mucosal live vector vaccine against recurrent *Clostridium difficile* infections. UMB/JHU Industry Alliance Meeting. Johns Hopkins University, MD. 2010.

Administrative Service

Institutional Service

1993-2009 Head, *Salmonella* Live Vector Vaccine Unit
Center for Vaccine Development
Division of Geographic Medicine
University of Maryland School of Medicine

2000–2007 CVD Committee: Frontiers in Vaccinology Visiting Professor Selection Committee; Chair

2005-2009 Biopolymer Advisory Committee

2005–Present Associate member, Graduate Faculty of the University of Maryland Graduate School

2009-Present Chief, *Salmonella* Vaccine Section
Center for Vaccine Development
Division of Geographic Medicine
University of Maryland School of Medicine

9/14/2011 Proxy member, Scientific Review Committee, University of Maryland Baltimore.

05/29/2016- BIORESCO Advisory Committee

Local and National Service

1997-present Scientific reviewer of manuscripts for various peer-reviewed journals including Infection and Immunity, Nature Biotechnology, PLoS ONE,

FEMS Immunology and Medical Microbiology, Clinical and Vaccine Immunology, and Vaccine.

2003 Served as a grant reviewer for the Welcome Trust, London UK.

2009-present Scientific reviewer of applications for NIH-sponsored SBIR/STTR Phase I and Phase II awards.

Teaching Service

Medical Student Teaching

2001-present Host Defenses and Infectious Diseases (MMIC 520, MSPR520); Laboratory Facilitator. Small group setting with 15-20 2nd year medical students. ~8 hours of teaching per year

Graduate Teaching

1999 Molecular Microbiology MMIC 701; Instructor. Small group setting with 8-10 graduate students. 1 hour of teaching.

2001-present Vaccinology Course PREV 627; Lecturer. Small group setting with 8-10 fellows. 1 hour of direct teaching per year every other year

2005, 2006 Bioterrorism and Biodefense Seminar Series (PATH 789) Instructor. Small group setting with 8-10 graduate students. 2 hour lecture on botulinum neurotoxins

2005 Bacterial Genetics (DBMS635/MMIC636); Instructor. Small group setting with 8-10 graduate students. 2 hour lecture on plasmid biology

2009, 2011 MEDT 671; Instructor. Small group setting with 8-10 graduate students. 2 hour lecture on plasmid biology

Mentoring Activities of Doctoral Candidates

1995-1999 Thames Pickett
1998-2002 Carl Brinkley
2002-2004 Kristen J. Kanack
2005-2008 Maura C. Strauman
2005-2009 Cara E. Morin
2007-2009 Nick Morin
2009-2010 Jocelyn Hauser
2010-2014 Vidhya Vijayakumar (transferred to University of Virginia, J. Nataro Advicor)
2013-2016 Kevin Chen
2016 Avital Shimanovich

Post-doctoral Mentoring

1993-1994 Oscar Gomez-Duarte
1996-1998 Nadav Orr
1999-2000 Rodrigo F. Vergara
2001-2006 Licheng Zhao
2003-2006 Stephen Angeloni

2004-2008	Patricia Ruiz Olvera
2005-2006	Jennifer Snyder
2006-2008	Chee-Mun Fang
2006-2007	Yuansha Chen
2007-2010	Sharon Tennant
2009-2012	Raphael Simon
2015-present	Yixuan Zhu

Mentored Visiting Scientist

2006	Haim Levy
2009-2011	Orit Gat

Grant Support

Active Grants

05/14/12-11/13/17 (Project Manager, 25%; PI- M. Levine)
"Vaccines to prevent invasive non-typhoidal *Salmonella* infections in infants and young children in sub-Saharan Africa"
Wellcome Trust, no grant number assigned

Annual Direct Costs: $802,036
Total Direct Costs: $3,999,620

12/01/12-11/30/17 (PI, 50%)
"Mucosal live vector vaccine against recurrent *Clostridium difficile* infections"
NIH, NIAID

Annual Direct Costs: $250,000
Total Direct Costs: $1,250,000

03/01/14-02/28/19 (Co-Investigator, 25%)
Multi-component Cooperative Agreement (U19)
"Immunoprophylactic Strategies to Control Emerging Enteric Infections"
Project 2 "Novel Immunoprophylaxes against *Clostridium difficile* Infection"
NIH, NIAID

Annual Direct Costs: $660,846
Total Direct Costs: $3,304,230

Completed Grants

7/1/97-6/30/98 (PI, 50%)
"Characterization of Murine Intranasal Model for the Immunogenicity of Attenuated *Salmonella typhi*-based Carrier Vaccines"
DRIF98 Intramural Award, SOM, **02-1-30882**
Total Award: $15,000

3/31/97-6/30/2000 (PI, 40%)
"Construction of a single-dose oral *Salmonella typhi*-based live vector vaccine against diphtheria and typhoid fever"

World Health Organization, **VRD-I5/181/399**
Total Award: $80,000

04/01/98-03/31/04 (Co-investigator, 40%) PI: M. M. Levine
"Recombinant and live oral *Salmonella typhi* hybrid vaccines"
NIH, **R01-AI029471**
Total Award: $1,512,924

07/01/00-06/30/06 (Co-investigator, 40%) PI: M. M. Levine
"Bacterial live vector-based vaccine against malaria"
NIH, **R01-AI-40297**
Total Award: $1,250,000

09/01/00-02/28/09 (Co-investigator, 30%) PI: M. M. Levine
"Development of a "stealth" mucosal measles vaccine that can immunize young infants (2-6 months of age) in developing countries, despite the presence of maternal antibodies"
Bill and Melinda Gates Foundation
Total Award: $20,830,454

09/04/03-02/29/09 (Co-investigator, 40%) PI: M. M. Levine
Mid-Atlantic Regional Center for Excellence for Biodefense and Emerging Infectious Diseases Research (RCE). "Defense against biowarfare and emerging infectious agents. **Sub-project 1.4: "*Salmonella* Typhi-based anthrax vaccine compatible with the prime-boost strategy"**
NIH, **U54 AI057168**
Total Award: $1,432,850

10/01/03-01/31/08 (Co-investigator, 30%) PI: J. Nataro
Multi-component Cooperative Agreement (U19); Live vector vaccines against agents of bioterror. **Project 2: "Attenuated *Salmonella* Typhi-based vaccines against botulinum toxin" (Galen, PI)**
NIH, NIAID, **U19 AI056578**
Total Award: $1,166,102

03/01/09-02/28/11 (PI; 25%)
Middle Atlantic Regional Center for Excellence for Biodefense and Emerging Infectious Diseases Research (MARCE) "Ultra-fast and sensitive detection of non-typhoidal *Salmonella* in human blood samples"
NIH, NIAID, **2 U54 AI057168**
Total Award: $105,225

11/01/10-04/30/12 (PI; 20%)
"Increased stability and immunogenicity of bacterial vaccines expressing intracellular thermophilic chaperones."
Bill and Melinda Gates Foundation, **OPP1024631**
Total Award: $100,000 (No IDCs)

03/01/09-02/28/14 (Co-Inv, 20%; PI-M. Levine)
Middle Atlantic Regional Center for Excellence for Biodefense and Emerging Infectious Diseases Research (MARCE) "Emerging pathogen-host

interactions. Development and testing of vaccines, diagnostics and therapeutics". "*Vaccine strategy for broad spectrum protection against non-typhoidal Salmonella*"
NIH, NIAID, **2 U54 AI057168**
Total Award: $975,638

11/11/11-03/30/13 (Co-Inv, 30%; PI-M. Levine)
"Ultra-fast and Sensitive Detection of Typhoidal and Non-typhoidal Salmonella in Blood Using Microwave-Accelerated Metal-Enhanced Fluorescence ("MAMEF")"
Bill and Melinda Gates Foundation, **OPP1039437**
Total Award: $833,780

04/01/12-03/31/13 (Nataro, originating PI; **PI transferred to Galen, 2011**; 20%)
"Live Attenuated Bacterial Vaccines Against Plague"
NIH, NIAID, **U01 AI077911**
Total Carryover Costs: $468,994

Patents and Inventions

United States

1] Issued patents covering expression plasmids and their use in attenuated *S.* Typhi live vector vaccines. U.S. Patent No. 6,413,768, titled "Expression Plasmids," issued July 2, 2002; U.S. Patent No. 6,969,513, titled "Plasmid Maintenance System for Antigen Delivery," issued November 29, 2005; U.S. Patent No. 6,977,176, issued December 20, 2005; U.S. Patent No. 7,125,720, issued October 24, 2006; U.S. Patent No. 7,138,112, issued November 21, 2006; U.S. Patent No. 7,141,408, issued November 28, 2006; and U.S. Patent No. 8,076,130, issued December 31, 2011.

2] Issued patents covering antigen export technology and uses in attenuated *S.* Typhi live vector vaccines. U.S. Patent No. 7,056,700, titled "Use of ClyA Hemolysin for Excretion of Proteins," issued June 6, 2006, and U.S. Patent No. 7,459,161, titled "Methods for Eliciting an Immune Response Using Cytolysin and Hemolysin Fusion Protein," issued December 2, 2008.

3] Issued patents covering antigen export technology using non-hemolytic versions of ClyA. U.S. Patent No. 9,051,574, titled "Non-hemolytic ClyA for excretion of proteins," issued June 9, 2015.

4] Patent applications for attenuated *S*. Typhi-based live vector vaccines expressing chromosomally integrated foreign antigens. U.S. Patent Application No. 20120282293A1, titled "Multivalent Live Vector Vaccine against *Clostridium difficile*-Associated Disease," filed November 8, 2012. U.S. Patent Application No. 20150216959A1, titled "Bacterial Live Vector Vaccines Expressing Chromosomally-integrated Foreign Antigens," filed August 6, 2015.

Worldwide

Australian Patent Number: 200129770, issued 7/19/07 entitled "Use of ClyA Hemolysin for Excretion of Proteins"

European Patent Number 1412502, issued 7/21/10, entitled "Use of ClyA Hemolysin for

Excretion of Proteins" (validated in France, Germany, Italy, Spain and the United Kingdom)

Indian Patent Number 202579, issued 3/2/07, entitled "*Use of ClyA Hemolysin for Excretion of Proteins*"

Japanese Patent Number 3976685, issued 6/29/07, entitled "*Use of ClyA Hemolysin for Excretion of Proteins*"

International Patent Application No. PCT/US2010/56871, entitled "Multivalent live vector vaccine against *Clostridium difficile*-associated disease," filed Nov. 16, 2010.

Publications

Peer-reviewed journal articles

1. Lockman, H.A., J.E. Galen, and J.B. Kaper. Further analysis of the *Vibrio cholerae* enterotoxin genes: nucleotide sequence analysis of the gene encoding the ADP-ribosylating subunit. J.Bacteriol. 1984; 159:1086-1089.
2. Vimr, E.R., J. Galen, and J.B. Kaper. Molecular cloning and expression of *Vibrio cholerae* neuraminidase gene *nanH* in *Escherichia coli*. J. Bacteriol. 1988; 170:1495-1504.
3. Miliotis, M.D., J.E. Galen, J.B. Kaper, and J.G. Morris Jr. Development and testing of a synthetic oligonucleotide probe for the detection of pathogenic *Yersinia* strains. J. Clin. Micro. 1989; 27:1667-1670.
4. Roggentin, P., B. Rothe, J.B. Kaper, J. Galen, L. Lawrisuk, E.R. Vimr, and R. Schauer. Conserved sequences in bacterial and viral sialidases. Glycoconjugate J. 1989; 6:349-353.
5. Jerse, A.E., W.C. Martin, J.E. Galen, and J.B. Kaper. Oligonucleotide probe for detection of the enteropathogenic *Escherichia coli* (EPEC) adherence factor of localized adherent EPEC. J. Clin. Microbiol. 1990; 28:2842-2844.
6. Galen, J.E., J.M. Ketley, A. Fasano, S.H. Richardson, S.S. Wasserman, and J.B. Kaper. Role of *Vibrio cholerae* neuraminidase in the function of cholera toxin. Infect. Immun. 1992; 60:406-415.
7. Trucksis, M., J.E. Galen, J. Michalski, A. Fasano, and J.B. Kaper. Accessory cholera enterotoxin (Ace), the third toxin of a *Vibrio cholerae* virulence cassette. Proc. Natl. Acad. Sci. USA 1993; 90:5267-5271.
8. Ketley, J.M., J. Michalski, J.E. Galen, M.M. Levine, and J.B. Kaper. Construction of genetically marked *Vibrio cholerae* O1 vaccine strains. FEMS Microbiol. Let. 1993; 111:15-22.
9. Michalski, J., J.E. Galen, A. Fasano, and J.B. Kaper. CVD110, an attenuated *Vibrio cholerae* O1 El Tor live oral vaccine strain. Infect. Immun. 1993; 61:4462-4468.
10. Levine, M.M., J. Galen, E. Barry, F. Noriega, S. Chatfield, M. Sztein, G. Dougan, C. Tacket. Attenuated *Salmonella* as live oral vaccines against typhoid fever and as live vectors. J. Biotechnology 1995;44:193-196.
11. Gomez-Duarte, O., J. Galen, S.N. Chatfield, R. Rappuoli, L. Eidels and M.M. Levine. Expression of fragment C of tetanus toxin fused to a carboxyl-terminal fragment of diphtheria toxin in *Salmonella typhi* CVD 908 vaccine strain. Vaccine. 1995;13:1596-1602.
12. Barry, E.M., O.Gomez-Duarte, S. Chatfield, M. Pizza, R. Rappuoli, G.A. Losonky, J.E. Galen, and M. M. Levine. Expression and immunogenicity of pertussis toxin S1 subunit-tetanus toxin fragment C fusions in *Salmonella typhi* vaccine strain CVD 908. Infect. Immun. 1996; 64: 4172-4181.
13. Galen, J.E., O. Gómez-Duarte, S. Chatfield, R. Rappouli, G. Losonsky, and M.M. Levine. A murine model of intranasal immunization to assess the immunogenicity of attenuated *Salmonella typhi* live vector vaccines in stimulating serum antibody responses to foreign

antigens. Vaccine. 1997; 15: 700-708.

14. Levine, M.M., J. Galen, E. Barry, F. Noriega, C. Tacket, M. Sztein, S. Chatfield, G. Dougan, G. Losonsky, and K. Kotloff. Attenuated *Salmonella typhi* and *Shigella* as live oral vaccines and as live vectors. Behring Inst. Mitt. 1997; 98: 120-123.
15. Orr, N., J.E. Galen, and M.M. Levine. Expression and immunogenicity of CRM_{197} and fragments of diphtheria toxin in *Salmonella typhi* vaccine strain CVD 908-*htrA*. Infect. Immun. 1999; 67: 4290 - 4294.
16. Galen, J.E., J. Nair, J.Y. Wang, S. Wasserman, M. Tanner, M. Sztein, and M. M. Levine. Optimization of plasmid maintenance in the attenuated live vector vaccine strain *Salmonella typhi* CVD 908-*htrA*. Infect. Immun. 1999; 67: 6424 - 6433.
17. Pickett, T., M. Pasetti, J.E. Galen, M. Sztein, and M.M. Levine. In vivo characterization of the murine intranasal model for assessing the immunogenicity of attenuated *Salmonella enterica* serovar Typhi strains as live mucosal vaccines and as live vectors. Infect. Immun. 2000; 68: 205 - 213.
18. Wang, J.Y., F. R. Noriega, J.E. Galen, E. Barry, and M.M. Levine. Constitutive expression of the Vi polysaccharide capsular antigen in attenuated *Salmonella enterica* Serovar Typhi oral vaccine strain CVD 909. 2000; Infect. Immun. 68: 4647-4652.
19. Wu, S., M. Beier, M.B. Sztein, J.E.Galen, T. Pickett, A.A. Holder, O.G. Gomez-Duarte, and M.M. Levine. Construction and immunogenicity in mice of attenuated *Salmonella typhi* expressing *Plasmodium falciparum* merozoite surface protein 1 (MSP-1) fused to tetanus toxin fragment C. J. Biotechnology. 2000; 83: 125-135.
20. Tacket, C.O., J.E. Galen, M.B. Sztein, G. Losonsky, T.L. Wyant, J. Nataro, S.S. Wasserman, R. Edelman, S. Chatfield, G. Dougan, and M.M. Levine. Safety and immune responses to attenuated *Salmonella enterica* serovar Typhi oral live vector vaccines expressing tetanus toxin fragment C. Clin. Immunol. 2000; 97: 146-153.
21. Orr, N., J.E. Galen, and M.M. Levine. Novel use of anaerobically induced promoter, *dmsA*, for controlled expression of Fragment C of tetanus toxin in live attenuated *Salmonella enterica* serovar Typhi strain CVD 908-*htrA*. Vaccine. 2001; 19: 1694-1700.
22. Altboum, Z., E.M. Barry, G. Losonsky, J.E. Galen, and M.M. Levine. Attenuated *Shigella flexneri* 2a delta *guaBA* strain CVD1204 expressing enterotoxigenic *Escherichia coli* (ETEC) CS2 and CS3 fimbriae as a live mucosal vaccine against *Shigella* and ETEC infection. Infect. Immun. 2001; 69: 3150-3158
23. Wang, J.Y., M. F. Pasetti, F. R. Noriega, R. J. Anderson, S. S. Wasserman, J.E. Galen, M. B. Sztein, and M.M. Levine. Construction, characterization and immunogenicity of attenuated delta *guaBA Salmonella enterica* serovar Typhi strain CVD 915. Infect. Immun. 2001; 69: 4734-4741.
24. Galen, J.E. and M.M. Levine. A "flawless" live vector vaccine strain: Can it be engineered? Trends in Microbiology. 2001; 9: 372-376.
25. Altboum, Z., M.M. Levine, J.E. Galen, and E.M. Barry. Genetic characterization and immunogenicity of coli surface antigen 4 from enterotoxigenic *Escherichia coli* when it is expressed in a *Shigella* live-vector strain. Infect. Immun. 2003; 71: 1352-1360.
26. Rang, C., J.E. Galen, J.B. Kaper, and L. Chao. Fitness cost of the green fluorescent protein in gastrointestinal bacteria. Can. J. Microbiol. 2003; 49: 531-7.
27. Wyborn, N.R., A. Atkins, R.E. Roberts, S.J. Jamieson, S.Tzokov, P.A. Bullough, T.J. Stillman, P.J. Artymiuk, J.E. Galen, L. Zhao, M.M. Levine, and J. Green. Properties of Hemolysin E (HlyE) from a pathogenic *Escherichia coli* avian isolate and studies of HlyE export. J. Biol. Chem. 2003; 150: 1495-505.
28. Galen, J.E., L. Zhao, M. Chinchilla, J.Y. Wang, M.F. Pasetti, J. Green, and M.M. Levine. Adaptation of the endogenous *Salmonella* Typhi *clyA* hemolysin for antigen export enhances the immunogenicity of anthrax protective antigen domain 4 expressed by the attenuated live vector vaccine strain CVD 908-*htrA*. Infect. Immun. 2004; 72: 7096-7106.

29. Stokes, M.G.M, R.W. Titball, B.N. Neeson, J.E. Galen, N.J. Walker, A.J. Stagg, D.C. Jenner, J.E. Thwaite, J.P. Nataro, L.W.J. Baillie, and H.S. Atkins. Oral administration of a *Salmonella enterica*-based vaccine expressing *Bacillus anthracis* Protective Antigen confers protection against aerosolized *B. anthracis*. Infect. Immun. 2007; 75: 1827-1834.
30. Chinchilla, M., M. F. Pasetti, S. Medina-Moreno, J.Y. Wang, O. G. Gomez-Duarte, R. Stout, M. M. Levine, and J. E. Galen. Enhanced immunity to *Plasmodium falciparum* circumsporozoite protein using *Salmonella* Typhi expressing PfCSP and a PfCSP-encoding DNA vaccine in a heterologous prime-boost strategy. Infect. Immun. 2007; 75: 3769-79.
31. Fang, C.M., J.Y. Wang, M. Chinchilla, M.M. Levine, W.C. Balckwelder, and J.E. Galen. Use of *mchI* encoding immunity to the antimicrobial peptide microcin H47 as a plasmid selection marker in attenuated bacterial live vectors. Infect. Immun. 2008; 76: 4422-30.
32. Galen J.E., M. Chinchilla, M.F. Pasetti, J.Y. Wang, L. Zhao, I. Arciniega-Martinez, D.J. Silverman, and M.M. Levine. Mucosal immunization with attenuated *Salmonella* Typhi expressing anthrax PA83 primes monkeys for accelerated serum antibody responses to parenteral PA83 vaccine. J. Infect. Dis. 2009; 199: 326-35.
33. Galen,J.E., M.F. Pasetti, S. Tennant, P. Ruiz-Olvera, M.B. Sztein, and M.M. Levine. *Salmonella enterica* serovar Typhi Live Vector Vaccines Finally Come of Age. Immunol. Cell Biol. 2009; 87: 400-12.
34. Galen J.E., J.Y. Wang, M. Chinchilla, C. Vindurampulle, J.E. Vogel, H. Levy, W.C. Blackwelder, M.F. Pasetti, and M.M. Levine. A new generation of stable, non-antibiotic, low copy number plasmids improve immune responses to foreign antigens in *Salmonella enterica* serovar Typhi live vectors. Infect. Immun. 2010; 78: 337-47.
35. Tennant SM, S. Diallo, H. Levy, S. Livio, S.O. Sow, M. Tapia, P.I. Fields, M. Mikoleit, B. Tamboura, K.L. Kotloff, J.P. Nataro, J.E. Galen, and M.M. Levine. Identification by PCR of non-typhoidal *Salmonella enterica* serovars associated with invasive infections among febrile patients in Mali. PLoS Negl. Trop. Dis. 2010; 4(3):e621.
36. Ramirez K, Y. Ditamo, J.E. Galen, L.W. Baillie, and M.F. Pasetti. Mucosal priming of newborn mice with S. Typhi Ty21a expressing anthrax protective antigen (PA) followed by parenteral PA-boost induces B and T cell-mediated immunity that protects against infection bypassing maternal antibodies. Vaccine. 2010; 28: 6065-75.
37. Tennant S.M, Y. Zhang, J.E. Galen, C.D. Geddes, and M.M. Levine. Ultra-fast and sensitive detection of non-typhoidal Salmonella using microwave-accelerated metal-enhanced fluorescence ("MAMEF"). PLoS One. 2011. Apr 8;6(4):e18700.
38. Simon R, S.M. Tennant, J.E. Galen, and M.M. Levine. Mouse models to assess the efficacy of non-typhoidal Salmonella vaccines: Revisiting the role of host innate susceptibility and routes of challenge. Vaccine. 2011. 29: 5094-106.
39. Tennant S.M, J.Y. Wang, J.E. Galen, R. Simon, M. Pasetti, O. Gat, and M.M. Levine. Engineering and pre-clinical evaluation of attenuated non-typhoidal *Salmonella* strains serving as live oral vaccines and as reagent strains. Infect. Immun. 2011. 79: 4175-4185.
40. Simon R, S. Tennant, J.Y. Wang, P. Schmidlein, A. Lees, R. Ernst, M. Pasetti, J. E. Galen, and M.M. Levine. *Salmonella enteritidis* Core-O Polysaccharide (COPS) conjugated to H:g,m flagellin as a candidate vaccine for protection against invasive infection with *Salmonella*. Infect. Immun. 2011. 79: 4240-4249.
41. Gat O, J.E. Galen, S. Tennant, R. Simon, W.C. Blackwelder, D.J. Silverman, M.F. Pasetti, and M.M. Levine. Cell-associated flagella enhance the protection conferred by mucosally-administered attenuated *Salmonella* Paratyphi A vaccines. PLoS Negl. Trop. Dis. 2011. Nov;5(11):e1373.
42. Galen J.E., R. Simon, and R.K. Ernst. *Salmonella* expressing detoxified lipopoly-saccharide is immunogenic and protective both as an attenuated vaccine and for delivery of foreign antigens. Expert Rev Vaccines. 2011; 10: 1679-82.

43. Mellado-Sanchez G, K. Ramirez, C.B. Drachenberg, J.Diaz-McNair, A.L. Rodriguez, J.E. Galen, J.P. Nataro, and M.F. Pasetti. Characterization of systemic and pneumonic murine models of plague infection using a conditionally virulent strain. Comp. Immunol. Microbiol. Infect. Dis. 2013: 36: 113-28.
44. Wang J.Y., R. H. Harley, and J.E. Galen. Novel methods for expression of foreign antigens in live vector vaccines. Hum. Vaccin. Immunother. 2013. 9(7): 1558-1564.
45. Simon R, Wang JY, Boyd MA, Tulapurkar ME, Ramachandran G, Tennant SM, Pasetti M, Galen J.E., Levine MM. Sustained protection in mice immunized with fractional doses of Salmonella Enteritidis core and O polysaccharide-flagellin glycoconjugates. PLoS One. 2013. 8(5): e64680. doi:10.1371/journal.pone.0064680.
46. Galen J.E. and Curtiss R 3rd. The delicate balance in genetically engineering live vaccines. Vaccine. 2014. 32(35):4376-85.
47. Boyd MA, S.M. Tennant, V.A. Saague, R. Simon, K. Muhsen, G. Ramachandran, A.S. Cross, J.E. Galen, M.F. Pasetti, and M.M. Levine. Serum bactericidal assays to evaluate typhoidal and nontyphoidal Salmonella vaccines. Clin. Vaccine Immunol. 2014. 21(5):712-21.
48. Galen J.E., Wang JY, Carrasco JA, Lloyd SA, Mellado-Sanchez G, Diaz-McNair J, Franco O, Buskirk AD, Nataro JP , Pasetti MF. A bivalent typhoid live vector vaccine expressing both chromosome- and plasmid-encoded *Yersinia pestis* antigens fully protects against murine lethal pulmonary plague infection. Infect. Immun. 2015. 83(1): 161-72.
49. Boyd M.A., S.M. Tennant, J.H. Melendez, D. Toema, J.E. Galen, C.D. Geddes, and M.M. Levine. Adaptation of red blood cell lysis represents a fundamental breakthrough that improves the sensitivity of Salmonella detection in blood. J. Appl. Microbiol. 2015. 118(5):1199-209.
50. Tennant S.M., P. Schmidlein, R. Simon, M.F. Pasetti, J.E. Galen, and M.M. Levine. Refined live attenuated *Salmonella enterica* serovar Typhimurium and Enteritidis vaccines mediate homologous and heterologous serogroup protection in mice. Infect. Immun. 2015. 83(12):4504-12.
51. Ramachandran G, Boyd MA, MacSwords J, Higginson EE, Simon R, Galen JE, Pasetti MF, Levine MM, Tennant SM. 2016. An Opsonophagocytic Assay to Evaluate Immunogenicity of Non-Typhoidal Salmonella Vaccines. Clin Vaccine Immunol. In press.

Book Chapters

1. Nishibuchi, M., J.E. Galen, and J.B. Kaper. The *tdh* gene (Thermostable Direct Hemolysin Gene) of *Vibrio parahaemolyticus*. In: Advances in Research on Cholera and Related Diarrheas, Vol. 4. Kuwahara and N.F. Pierce (eds.). KTK Scientific Publishers, Tokyo, 1988, pp. 145-157.
2. J.E. Galen, E.R. Vimr, L. Lawrisuk, and J.B. Kaper. Cloning, sequencing, and expression of the gene, *nanH*, for *Vibrio cholerae* neuraminidase. In: Advances in Research in Cholera and Related Diarrheas, Vol. 7. R.B. Sack and Y. Zinnake (eds.). KTK Scientific Publishers, Tokyo, 1990, pp. 143-153.
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Major Invited Presentations

International

1. Galen J.E. and M.M. Levine. Development of a novel secretion system for *Salmonella* Typhi live vectors. Vaccines for Enteric Diseases VED 2001. Tampere, Finland. 2001.
2. Galen J.E. and M.M. Levine. Novel engineering of attenuated *Salmonella enterica* serovar Typhi strains for use as live vectors. Society for General Microbiology Spring Conference. Dublin, Ireland. 2012

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3. Galen J.E. and M.M. Levine. Optimization of plasmid maintenance in the attenuated live vector vaccine strain *Salmonella typhi* CVD 908-*htrA*. Molecular Approaches to Vaccine Design. Session 7, Delivery Systems. Cold Spring Harbor Laboratory, Cold Spring Harbor, New York. 1999.
4. Galen J.E. and M.M. Levine. Use of a novel secretion system for expression of *Plasmodium falciparum* immunogens in CVD908-*htrA.* Falciparum Malaria MSP-1 Workshop: Progress toward MSP-1 vaccine development and testing. Malaria Vaccine Initiative at PATH. Bethesda, Maryland. 2000.
5. Galen J.E. and M.M. Levine. Live, oral, attenuated *Salmonella* Typhi vaccine strains as carriers of heterologous antigens. 225th ACS National Meeting, New Orleans LA. 2003.
6. Galen J.E., L. Zhao, M. Chinchilla, J.Y. Wang, M.F. Pasetti, S.M. Moreno, and M.M. Levine. *Salmonella* Typhi-based anthrax vaccine. Regional Centers for Biodefense and Emerging Infectious Diseases Research, 2nd annual meeting. Galveston, TX. 2005.
7. Galen J.E., L. Zhao, M. Chinchilla, J.Y. Wang, M.F. Pasetti, S.M. Moreno, and M.M. Levine. Refining a *Salmonella* Typhi-based live vector anthrax vaccine. Regional Centers for Biodefense and Emerging Infectious Diseases Research, 3nd annual meeting. New York, NY. 2006.
8. Galen J.E., F.T. Robb, and M.M. Levine. Engineering of attenuated *Salmonella enterica* serovar Typhi strains for use as live vector vaccines. Fourth International Rushmore Conference on Enteric Diseases. Chicago, IL. 2011.
9. Galen J.E., G. Mellado-Sanchez and M.M. Pasetti. Novel methods for expression of foreign antigens in live vector vaccines. iCubed's 6th Annual Vaccine Renaissance Conference. Providence, RI. 2012.

Local

10. Galen J.E. Development of *Salmonella* Typhi as live vector vaccines. Bioscience Research & Technology Review Day. University of Maryland College Park. 2003.
11. Galen J.E. Expression of *Bacillus anthracis* vaccine antigens in attenuated *Salmonella* Typhi. U.S. Army Medical Research Institute for Infectious Diseases (USAMRIID) seminar series. Fort Detrick, MD. 2004.
12. Galen J.E. Towards a mucosal live vector vaccine against recurrent *Clostridium difficile* infections. UMB/JHU Industry Alliance Meeting. Johns Hopkins University, MD. 2010.