

Sheila Marie Keating PhD MSPH
Blood Systems Research Institute
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EDUCATION

July 2006 **Weatherall Institute of Molecular Medicine**, Open University,
Centre for Vaccinology and Tropical Medicine,
Churchill Hospital, Oxford, UK
PhD research Supervisor: Professor Adrian Hill

May 1999 **Tulane School of Public Health and Tropical Medicine**, New Orleans, LA
MSPH in Tropical Medicine

May 1995 **College of the Holy Cross**, Worcester, MA
BA in Biology

EMPLOYMENT

July 2008 - present

Blood Systems Research Institute, San Francisco, CA

Head Core Immunology

- Developed novel methods for testing incident HIV infection and directed routine testing in coordination with US institutions and the Centers for Disease Control.
- Coordinated with international and US collaborators in studying immune responses to blood borne pathogens.
- Analyzed data for publication and presentation.
- Wrote grants for clinical studies.

Principle investigators: Michael Busch, Director.

November 2005 – November 2007

**Department of Infectious Diseases and Microbiology, Institute of Child Health,
University College London**, London, UK

B cell Memory and Pneumococcal Vaccines, Postdoctoral Research Fellow

- Developed protocols for expanding and tracking *in vitro* memory B cell responses to pneumococcal vaccines.
- Identified methods for isolating antigen specific cells to study their phenotype and function.
- Performed opsonophagocytic killing assays to determine the presence of vaccine induced antibodies against pneumococcal bacterial strains and their functional capacity.
- Acted as safety officer for the department and laboratory managers.

Principal investigator: David Goldblatt, MD; Professor of Medicine.

September 2002 – November 2005

Nuffield Department of Medicine, University of Oxford, Oxford, UK

Malaria Vaccine Program, Centre for Clinical Vaccinology and Tropical Medicine

Research Assistant/PhD Student

- Worked as interim lead immunologist from July 2003 to July 2004.
- Collected and processed clinical trial samples for ongoing malaria vaccine trials.
- Conducted immunological analysis of samples in clinical trials based in Oxford, UK, Farafenni, The Gambia, and Kilifi, Kenya.
- Studied cellular immune responses by ELISPOT and flow cytometry.
- Identified memory cells after vaccination.
- Analyzed results for presentation and in preparation for publication.
- Developed new techniques for studying cellular immune responses in malaria vaccinated individuals.

- Trained personnel from Oxford and field sites in the Gambia and Kenya.

Principal Investigator: Adrian Hill, M.D. D. Phil; Professor of Medicine.

May 2000 – September 2002

Johns Hopkins University, School of Medicine, Baltimore, MD

Division of Infectious Diseases, Core Immunology Laboratory, HIV Prevention Trials Network

Senior Research Program Coordinator

- Organized and coordinated research at the core laboratory with field laboratory sites internationally and at laboratories located within the United States.
- Participated in the development of protocols for international clinical trials.
- Insured equipment maintenance contracts and quality control procedures for the laboratory.
- Coordinated domestic and international shipments.
- Standardized techniques in ELISPOT, FACS analysis, and other assays to determine cellular immune responses in patients with HIV.
- Designed consensus protocols for studying cytokine and chemokine profiles using FACS and ELISPOT.
- Trained international site personnel in techniques to study cellular immune responses.
- Responsible for quality control monitoring at the core laboratory and at laboratory facilities at the international sites.

Principal Investigator: Robert C. Bollinger, M.D., MPH

Director of the Core Immunology Laboratory for the HIV Prevention Trials Network

June 1999 – May 2000

Henry M. Jackson Foundation for the Advancement of Military Medicine, Rockville, MD

Division of Retrovirology and Vaccine Development,

Research Assistant I

- Performed research and development of molecular diagnostic methods for HIV.
- Evaluated novel rapid diagnostic tools used for the detection of HIV.
- Tested and monitored clinical HIV levels using Amplicor HIV-1 monitor PCR test, ELISA, and EIA.
- Detected RNA expression for various experiments using real-time PCR.
- Genotyped patient samples for wild type or polymorphic expression of chemokine co-receptors for HIV.
- Used molecular manipulation and general molecular biological techniques including PCR, RT-PCR, sequencing, transfection, transformation, plasmid preparations, and bacterial and mammalian cell culture.

Principal Investigator: Nelson Michael, M.D., Ph.D.

September 1998-June 1999

Tulane School of Medicine, Center for Infectious Diseases, New Orleans, LA

Research Assistant

- Worked towards cloning a strain of SIVcpz to elucidate possible evolutionary pathways of HIV-1.
- Utilized standard molecular and biochemical techniques.
- Maintained cell lines necessary for experiments.

Principal Investigator: Scott Michael, Ph.D.

March 1997-August 1998

The University of Connecticut Health Center,

Center for the Immunotherapy of Cancer and Infectious Diseases, Farmington, CT

Administrative Program Assistant

Wrote and edited grant applications.

- Prepared graphs and diagrams for presentation and publication.
- Maintained research records.
- Coordinated research activities with financial and general administration.
- Directed laboratory administration.

Principal Investigator: Pramod K. Srivastava, Ph.D.

March 1996-March 1997

Fordham University,

Cancer Immunology Program, New York, NY

Administrative Assistant

- Directed laboratory maintenance and administration.
- Scheduled meetings, seminars and speakers.
- Arranged travel itineraries and accommodations.

Principal Investigator: Pramod K. Srivastava, Ph.D.

Summer 1992, Summer 1993

Boston University Medical Center

Naval Blood Research Laboratory, Boston, MA

Laboratory Technician

- Analyzed blood components in testing blood filtration products for FDA approval.
- Entered data for inventory control.
- Analyzed results and wrote summaries of data.

Principal Investigator: C. Robert Valeri, M.D.

Awards and Professional Memberships

2005 Dorothy Price Medal for Immunology, National University Ireland, Maynooth, Kildare, Ireland.

British Society of Immunology Member, January 2007.

Publications

Keating S.M., R. C. Bollinger, T. C. Quinn, J. B. Jackson, and L. M. Carruth. 2002. Cross-clade T Lymphocyte Mediated Immunity to HIV-1. Implications for Vaccine Design and Immunodetection Assays. *AIDS Res Hum Retroviruses*. 18(14):1067-79.

Patke D.S, S. Lagan, L. M. Carruth, S. M. Keating, B. P. Sabunday, J. B. Margolick, T. C. Quinn, R. C. Bollinger. 2002. Association of Gag-specific T lymphocyte Responses During the Early Phase of HIV-1 Infection and Lower Viral Set Point. *J Infect Dis*. 186(8):1177-80.

Moorthy, V. S., E. B. Imoukhuede, S. Keating, M. Pinder, D. Webster, M. A. Skinner, S. C. Gilbert, G. Walraven, and A. V. Hill. 2004. Phase 1 evaluation of three highly immunogenic prime-boost regimens, including a 12-month re-boosting vaccination, for malaria vaccination in Gambian men. *J Infect Dis*; 189:2213.

McShane H, Pathan AA, Sander CR, Keating SM, Gilbert SC, Huygen K, Fletcher HA, Hill AV. Recombinant modified vaccinia virus Ankara expressing antigen 85A boosts BCG-primed and naturally acquired antimycobacterial immunity in humans. *Nat Med*. 2004 Nov;10(11):1240-4.

Moorthy VS, E.B. Imoukhuede, P. Milligan, K. Bojang, S. Keating, P. Kaye, M. Pinder, S.C. Gilbert, G. Walraven, B.M. Greenwood, A.V.S. Hill. 2004. A Randomised, Double-Blind, Controlled Vaccine Efficacy Trial of DNA/MVA ME-TRAP Against Malaria Infection in Gambian Adults. *PLoS Med*. 2:33.

Vuola, J. M., S. Keating, D. P. Webster, T. Berthoud, S. Dunachie, S. C. Gilbert, and A. V. Hill. 2005. Differential immunogenicity of various heterologous prime-boost vaccine regimens using DNA and viral vectors in healthy volunteers. *J Immunol* 174:449.

Webster, D. P., S. Dunachie, J. M. Vuola, T. Berthoud, S. Keating, S. M. Laidlaw, S. J. McConkey, I. Poulton, L. Andrews, R. F. Andersen, P. Bejon, G. Butcher, R. Sinden, M. A. Skinner, S. C. Gilbert, and A. V. Hill. 2005. Enhanced T cell-mediated protection against malaria in human challenges by using the

recombinant poxviruses FP9 and modified vaccinia virus Ankara. *Proc Natl Acad Sci U S A*. 2005 Mar 29;102(13):4836-41.

Gilbert, S. C., V. S. Moorthy, L. Andrews, A. A. Pathan, S. J. McConkey, J. M. Vuola, S. M. Keating, T. Berthoud, D. Webster, H. McShane, and A. V. Hill. 2005. Synergistic DNA-MVA prime-boost vaccination regimes for malaria and tuberculosis. *Vaccine*. May 22;24(21):4554-61.

Keating, S.M., P. Bejon, T. Berthoud, J. Vuola, S. Todryk, D. P. Webster, V.S. Moorthy, S.J. McConkey, S.C. Gilbert, A.V.S. Hill. 2005. Durable Human Memory T Cells Quantifiable by Cultured ELISPOT Assays are Induced by Heterologous Prime Boost Immunization and Correlate with Protection against Malaria. *J. Immunol*, 175(9):5675-80.

Dunachie, S., M. Walther, J. Epstein, S. Keating, T. Berthoud, L. Andrews, R. F. Andersen, P. Bejon, N. Goonetilleke, I. Poulton, D. Webster, G. Butcher, J. Williams, K. Watkins, R. Sinden, T. L. Richie, S. Gilbert, D. J. Carucci, and A. Hill. 2006. A DNA prime-MVA boost vaccine encoding recombinant TRAP but not circumsporozoite protein partially protects healthy adults against *P. falciparum* sporozoite challenge. *Infect Immun.*; 74(10):5933-42.

Dunachie, S., M. Walther, J. Vuola, D. Webster, S. Keating, T. Berthoud, L. Andrews, P. Bejon, I. Poulton, G. Butcher, K. Watkins, R. Sinden, A. Leach, P. Morris, N. Tornieporth, F. Dubovsky, E. Tierney, J. Williams, D.G. Heppner, S. Gilbert, J. Cohen, and A. Hill. 2006. Immunogenicity and Efficacy in Humans of Prime Boost Immunisation with the Candidate Malaria Vaccine RTS, S/ASO2 and MVA-CS. *Vaccine*; 24(15):2850-9.

Imoukhuede E.B, T. Berthoud, P. Milligan, K. Bojang, J. Ismaili, S. Keating, D. Nwakanma, S. Keita, F. Njie, M. Sowe, S. Todryk, S.M. Laidlaw, T. Lang, S. Gilbert, B.M. Greenwood, A.V. Hill. 2006. Safety and immunogenicity of the malaria candidate vaccines FP9 CS and MVA CS in adult Gambian men. *Vaccine*. 2006 Oct 30;24(42-43):6526-33.

Bejon P., J. Mwacharo, O.K. Kai, S. Todryk, S. Keating, T. Lang, S.C. Gilbert, N. Peshu, K. Marsh, A.V. Hill. 2006. Immunogenicity of the candidate malaria vaccines FP9 and modified vaccinia virus Ankara encoding the pre-erythrocytic antigen ME-TRAP in 1-6 year old children in a malaria endemic area. *Vaccin.* 24(22):4709-15.

Walther M, F.M. Thompson, S. Dunachie, S. Keating, S. Todryk, T. Berthoud, L. Andrews, R.F Andersen, A. Moore, S.C. Gilbert, I. Poulton, F. Dubovsky, E. Tierney, S. Correa, A. Huntcooke, G. Butcher, J. Williams, R.E. Sinden, A.V. Hill. 2006. Safety, immunogenicity, and efficacy of prime-boost immunization with recombinant poxvirus FP9 and modified vaccinia virus Ankara encoding the full-length *Plasmodium falciparum* circumsporozoite protein. *Infect Immun*. 74(5):2706-16.

Bejon P., O.K. Kai, J. Mwacharo, S. Keating, T. Lang, S.C. Gilbert, N. Peshu, K. Marsh, A.V. Hill. 2006. Alternating vector immunizations encoding pre-erythrocytic malaria antigens enhance memory responses in a malaria endemic area. *Eur J Immunol*. 2006 Aug;36(8):2264-72.

Bejon P., J. Mwacharo, O.K. Kai, S. Todryk, S. Keating, T. Lang, S.C. Gilbert, N. Peshu, K. Marsh, A.V. Hill. 2006. Immunogenicity of the candidate malaria vaccines FP9 and modified vaccinia virus Ankara encoding the pre-erythrocytic antigen ME-TRAP in 1-6 year old children in a malaria endemic area. *Vaccine*; 24(22): 4709-15.

Bejon P., S. Keating, J. Mwacharo, O.K.Kai, S. Dunachie, M. Walther, T. Berthoud, T. Lang, J. Epstein, D. Carucci, P. Morris, J. Cohen, S.C.Gilbert, N. Peshu, K. Marsh, A.V.Hill. 2006. Early IFN gamma and IL 2 responses to vaccination predict the late resting memory in malaria naive and malaria exposed individuals. *Infect Immun*. 2006 Nov;74(11):6331-8.

S. J. Dunachie, M. Walther, J. E. Epstein, S. Keating, T. Berthoud, L. Andrews, R. F. Andersen, P. Bejon, N. Goonetilleke, I. Poulton, D. P. Webster, G. Butcher, K. Watkins, R. E. Sinden, G. L. Levine, T. L. Richie, J. Schneider, D. Kaslow, S. C. Gilbert, D. J. Carucci, and A. V. S. Hill. 2006. A DNA Prime-Modified Vaccinia Virus Ankara Boost Vaccine Encoding Thrombospondin-Related Adhesion Protein but Not Circumsporozoite Protein Partially Protects Healthy Malaria-Naive Adults against Plasmodium falciparum Sporozoite Challenge. *Infection and Immunity*. 74(10):5933-42.

Bejon P, Mwacharo J, Kai O, Mwangi T, Milligan P, Todryk S, Keating S, Lang T, Lowe B, Gikonyo C, Molyneux C, Fegan G, Gilbert SC, Peshu N, Marsh K, Hill AV. 2006. A Phase 2b Randomised Trial of the Candidate Malaria Vaccines FP9 ME-TRAP and MVA ME-TRAP among Children in Kenya. *PLoS Clin Trials*. 1(6):e29.

Bejon P, Mwacharo J, Kai O, Todryk S, Keating S, Lowe B, Lang T, Mwangi TW, Gilbert SC, Peshu N, Marsh K, Hill AV. 2007. The induction and persistence of T cell IFN-gamma responses after vaccination or natural exposure is suppressed by Plasmodium falciparum. *J Immunol*. 179(6):4193-201.

Todryk S, A Pathan, S Keating, D Porter, T Berthoud, F Thompson, P Klenerman, AVS Hill. The relationship between human effector and memory T cells measured by ex vivo and cultured ELISPOT following recent and distal priming. *Immunology, in press*.

Conference Presentations

Keating S, M. Johnson, L. Ashton, U. Meltzer, P. Burbidge, K. Newton, J. Southern, E. Miller, D. Goldblatt and H. Baxendale. Cellular Analysis of memory responses to pneumococcal vaccines in the elderly, International Symposium on Pneumococci and Pneumococcal Diseases, June 2008.

Keating S, M. Johnson, L. Ashton, U. Meltzer, K. Newton, P. Burbidge, L. Carr, D. Goldblatt and H. Baxendale. Analysis of cellular and antibody responses to pneumococcal conjugate and polysaccharide vaccines. British Society of Immunology, February 2007.

Keating (Oral Presentation), M. Johnson, L. Ashton, P. Burbidge, L. Carr, D. Goldblatt and H. Baxendale. Detailed cellular analysis of memory responses to pneumococcal conjugate and polysaccharide vaccines. European Congress of Immunology, September 2006.

Keating S.M. (Oral Presentation) Cultured ELISPOT Measure Memory T Cells following Malaria Vaccination and Correlate with Protection Against Sporozoite Challenge. British Society of Immunology Meeting, Harrogate, December 2004.

Keating (Oral Presentation) Malaria and Memory: Characterizing Long-lasting Cellular Immune Responses, Oxford University Tropical Network Meeting, Kilifi, Kenya October 2004.

Keating SM Vuola JM Berthoud T, Bejon P, Webster D, Dunachie S, Moorthy V, Gilbert SC, Hill AVS. Heterologous Prime-Boost vaccination regimen of DNA with Modified Vaccinia Ankara (MVA) or fowlpox (FP9) generates long lasting T-cell mediated immune response. American Society of Tropical Medicine and Hygiene, Philadelphia, PA, USA December 2003.

Keating S M, L M Carruth, M N Lubaki, S Barnett, J B Jackson, T C Quinn, R C Bollinger, Co-expression of IFN- γ and MIP-1 β in HIV-1 gag-specific T lymphocytes from untreated, chronically infected individuals with low viral load, International AIDS Conference, Barcelona 2002.

M R Thakar, S M Keating, L S Bhonge¹, S Lakhashe¹, A K Rao¹, R C Bollinger, Characterization of HIV-1 gag and env specific responses in HIV-1 subtype C-infected individuals in India, International AIDS Conference, Barcelona 2002.

R C Bollinger, D S Patke, L M Carruth, S M Keating, S J Langan, B P Sabundayo, T C Quinn, J B Margolick, Relationship between gag-specific T lymphocyte responses during the early phase of human immunodeficiency virus type-1 infection and subsequent viral set point, International AIDS Conference, Barcelona 2002.

S.M.Keating, R.C. Bollinger, J.B.Jackson, L.M. Carruth. Matrix-based ELISPOT Assay for Identification of Cross-clade HIV-1-gag T Lymphocyte Reactivity. International HIV Vaccine Meeting, Philadelphia, 2001.

N. Lubaki, M. Kashamuka, L. Muse, L. Atibu, B. Milangu, N. Nzila, L. Cheng, H. Huiming, S. Keating, L. Carruth, T. Quinn, R. Bollinger. Gag-Specific CD8⁺ T-Lymphocyte Immunodominant Epitopes in HIV-1-infected Individuals from Democratic Republic of Congo. International AIDS Vaccine Meeting, Philadelphia, 2001.