CURRICULUM VITAE

E. Sally Ward, Ph.D.

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UNIVERSITY EDUCATION

1979-1982: B.A., First Class Honours in Natural Sciences (Part II course, Biochemistry), University of Cambridge, U.K.

1982-1985: Ph.D. in Biochemistry at the Department of Biochemistry, University of Cambridge, U.K. Dissertation title: Molecular genetics of an insecticidal delta-endotoxin from *Bacillus thuringiensis* var. *israelensis*. (Research supervisor: Prof. D.J. Ellar).

ACADEMIC APPOINTMENTS

1985-1988: Junior Research Fellow at Gonville and Caius College, Cambridge, whilst working at the Department of Biochemistry, University of Cambridge, U.K.

1988-1990: Stanley Elmore Senior Medical Research Fellow at Sidney Sussex College, Cambridge whilst working at the MRC Laboratory of Molecular Biology, Cambridge, U.K.

1990-1996: Assistant Professor in the Department of Microbiology, UT Southwestern Medical Center, Dallas, Texas, U.S.A.

1996-2002: Associate Professor with tenure, Department of Microbiology, UT Southwestern Medical Center, Dallas, Texas, U.S.A.

1998-2002: Associate Professor with tenure, Center for Immunology (Center formed in 1998; became Department of Immunology in 2007), UT Southwestern Medical Center, Dallas, Texas, U.S.A.

2002-2014: Professor, Department of Immunology, UT Southwestern Medical Center, Dallas, Texas, U.S.A.

2004-2014: Paul and Betty Meek-FINA Professorship in Molecular Immunology, UT Southwestern Medical Center, Dallas, Texas, U.S.A.

2014-2018: Professor, Department of Molecular and Cellular Medicine and Department of Microbial Pathogenesis and Immunology, Texas A&M Health Science Center, College Station, Texas, U.S.A.

2018-2020: Research Professor, Department of Molecular and Cellular Medicine and Department of Microbial Pathogenesis and Immunology, Texas A&M Health Science Center, College Station, Texas, U.S.A.

2018-present: Professor of Molecular Immunology and Director of Translational Immunology, Centre for Cancer Immunology, University of Southampton, U.K.

HONORS, FELLOWSHIPS AND PROFESSORSHIPS

1979-1981: Entrance Exhibition at Gonville and Caius College, Cambridge, U.K.

1981-1982: Senior Scholarship at Gonville and Caius College, Cambridge, U.K.

1982-1985: Graduate Scholarship at Gonville and Caius College, Cambridge, U.K.

1985: Elected into Junior Research Fellowship at Gonville and Caius College, Cambridge, U.K. Held from October 1985-September 1988.

1988: Elected into 'Stanley Elmore Senior Medical Research Fellowship' at Sidney Sussex College, Cambridge, U.K. Held from October 1988-August 1990.

1997-2000: Established Investigator Award, American Heart Association.

2004-2014: Paul and Betty Meek-FINA Professorship in Molecular Immunology, UT Southwestern Medical Center, Dallas, Texas, U.S.A.

2009-present: Board of Distinguished Advisors, The Antibody Society.

2011: Visiting Professor, University of Oslo, Norway.

2018-2023: Royal Society Wolfson Research Merit Award.

2020: Vice-President, The Antibody Society.

REVIEW PANELS, EDITORIAL BOARDS AND SCIENTIFIC ADVISORY BOARDS

1994: Department of Energy, Medical Applications and Biophysical Research Division.

1996-present: Member of special emphasis panels or ad hoc reviewer (for Immunological Sciences, Allergy and Immunology/Cellular and Molecular Immunology A Study sections), National Institutes of Health.

1996-present: ad hoc reviewer for Wellcome Trust (U.K.), Biotechnology and Biological Sciences Research Council (U.K.), Swiss National Science Foundation, Israel Science Foundation, Swedish Research Council for Engineering Sciences, Human Science Frontier Program and French National Research Agency.

1997-1999: American Heart Association, Texas Affiliate.

1993-2003: Editorial Advisory Board, Journal of Bioconjugate Chemistry.

2003-present: Editorial Board, Protein Engineering, Design and Selection (formerly Protein Engineering).

2009-2015: Member, Fellowship Review Committee, National Multiple Sclerosis Society.

2009-present: Editorial Board of mAbs.

2012: Programme Advisory Committee, Regional Centre for Biotechnology, Gurgaon, New Delhi, India.

2015-present: Scientific Advisory Board of the CPRIT Therapeutic Monoclonal Antibody Lead Optimization and Development Core Facility (Program leader: Zhiqiang An, Houston, TX).

2017-present: Scientific Advisory Board for Antibody Biology and Engineering Gordon Research Conference.

2019-present: Board of Directors, Antibody Society.

CONFERENCE ORGANIZATION

March-April 2009: Co-organizer of Keystone Meeting, '*Antibodies as Drugs*', Whistler, Vancouver, Canada.

March 2010: Lead co-organizer of a new Gordon Research Conference, '*Antibody Biology and Engineering*' held in Ventura, CA.

June 2016: Co-organizer of FASEB Science Research Conference ('*Immunoreceptors*'), Snowmass, CO.

June 2018: Lead co-organizer of FASEB Science Research Conference ('*Immunoreceptors and Immunotherapy*'), Snowmass, CO.

PUBLICATIONS

i) Papers in refereed journals

1. Ward, E.S. and Ellar, D.J. (1983) Assignment of the delta-endotoxin gene of *Bacillus thuringiensis* var. *israelensis* to a specific plasmid by curing analysis, *FEBS Letts*., **158**, 45-49.

2. Ward, E.S., Ellar, D.J. and Todd, J.A. (1984) Cloning and expression in *Escherichia coli* of the insecticidal delta-endotoxin gene of *Bacillus thuringiensis* var. *israelensis, FEBS Letts*., **175**, 377-381.

3. Ward, E.S. and Ellar, D.J. (1986) *Bacillus thuringiensis* var. *israelensis* delta-endotoxin: Nucleotide sequence and characterisation of the transcripts in *Bacillus thuringiensis* and *Escherichia coli, J. Mol. Biol.,* **191**, 1-11.

4. Ward, E.S., Ridley, A.R., Ellar, D.J. and Todd, J.A. (1986) *Bacillus thuringiensis* var. *israelensis* delta-endotoxin: Cloning and expression of the toxin in sporogenic and asporogenic strains of *Bacillus subtilis, J. Mol. Biol.*, **191**, 13-22.

5. Haider, M.Z., Ward, E.S. and Ellar, D.J. (1987) Cloning and heterologous expression of an insecticidal delta-endotoxin gene from *Bacillus thuringiensis* var. *aizawai* IC1 toxic to both lepidoptera and diptera, *Gene*, **52**, 297-302.

6. Ward, E.S and Ellar, D.J. (1987) Nucleotide sequence of a *Bacillus thuringiensis* var. *israelensis* gene encoding a 130 kD delta-endotoxin, *Nucleic Acids Res*., **15**, 7195.

7. Earp, D.J., Ward, E.S. and Ellar, D.J. (1987) Investigation of possible homologies between crystal proteins of three mosquitocidal strains of *Bacillus thuringiensis, FEMS Microbiol. Letts.*, **42**, 195-199.

8. Ward, E.S. and Ellar, D.J. (1988) Cloning and expression of two homologous genes of *Bacillus thuringiensis* var. *israelensis* which encode 130-kilodalton mosquitocidal proteins, *J. Bacteriol.*, **170**, 727-735.

9. Ward, E.S., Ellar, D.J. and Chilcott, C. N. (1988) Single amino acid changes in the *Bacillus thuringiensis* var. *israelensis* delta-endotoxin affect the toxicity and expression of the protein, *J. Mol. Biol*., **202**, 527-535.

10. Ward, E.S., Güssow, D., Griffiths, A., Jones, P.T. and Winter, G. (1989) Binding activities of a repertoire of single immunoglobulin variable domains secreted from *Escherichia coli, Nature,* **341,** 544-546.

11. Boulot, G., Eisele, J.L., Bentley, G.A., Bhat, T.N., Ward, E.S., Winter, G. and Poljak, R.J. (1990) Crystallization and preliminary X-ray diffraction study of the bacterially expressed Fv from the monoclonal anti-lysozyme antibody D1.3 and its complex with the antigen, lysozyme, *J. Mol. Biol.*, **213**, 617-619.

12. Ward, E.S. (1991) Expression and secretion of T cell receptor Vα and Vβ domains using *Escherichia coli* as a host, *Scand. J. Immunol*., **34**, 215-220.

13. Ward, E.S. (1992) Secretion of T cell receptor fragments from recombinant *Escherichia coli* cells, *J. Mol. Biol.*, **224**, 885-890.

14. Borrebaeck, C.A., Malmborg, A-C., Furebring, C., Michaelsson, A., Ward, S., Danielsson, L. and Ohlin, M. (1992) Kinetic analysis of recombinant antibody-antigen interactions: relation between structural domains and antigen binding, *Bio\technol*., **10**, 697-698.

15. Cumber, A.J., Ward, E.S., Winter, G., Parnell, G.D. and Wawrzynczak, E.J. (1992) Comparative stabilities *in vitro* and *in vivo* of a recombinant mouse antibody FvCys fragment and a bisFvCys conjugate, *J. Immunol*., **149**, 120-126.

16. Kim, J-K., Tsen, M-F., Ghetie, V. and Ward, E.S. (1994) Identifying amino acid residues that influence plasma clearance of murine IgG1 fragments by site-directed mutagenesis, *Eur. J. Immunol.*, **24**, 542-548.

17. Fields, B.A., Ysern, X., Poljak, R.J., Shao, X., Ward, E.S. and Mariuzza, R.A.(1994) Crystallization and preliminary X-ray diffraction study of a bacterially produced T-cell antigen receptor Vα domain, *J. Mol. Biol.*, **239**, 339-341.

18. Kim, J-K., Tsen, M-F., Ghetie, V. and Ward, E.S. (1994) Catabolism of the murine IgG1 molecule: evidence that both CH2-CH3 domain interfaces are required for persistence of IgG1 in the circulation of mice, *Scand. J. Immunol.*, **40**, 457-465.

19. Kim, J-K., Tsen, M-F., Ghetie, V. and Ward, E.S. (1994) Localisation of the site of the murine IgG1 molecule that is involved in binding to the murine intestinal Fc receptor, *Eur. J. Immunol*., **24**, 2429-2434.

20. Ciubotaru, M. and Ward, E.S. (1994) Expression of soluble T cell receptor fragments derived from a T cell clone associated with murine collagen induced arthritis, *Immunol. Letts*., **43**, 139-141.

21. Filikov, A.V., Jones, J.R., Myasoedov, N.F. and Ward, E.S. (1994) Application of solid state catalytic hydrogen isotope exchange to the tritium labeling of lysozyme, *J. Label. Cmpds. Radiopharm*., **XXXVI**, 179-185.

22. Ward, E.S. (1995) VH shuffling can be used to convert an Fv fragment of anti-hen egg lysozyme specificity to one that recognises a T cell receptor Vα, *Mol. Immunol*., **32**, 147-156.

23. Kim, J-K., Tsen, M-F., Ghetie, V. and Ward, E.S. (1995) Evidence that the hinge region plays a role in maintaining serum levels of the murine IgG1 molecule, *Mol. Immunol*., **32**, 467-475.

24. Ober, R.J. and Ward, E.S. (1995) Correcting for phase distortion of NMR spectra analyzed using singular value decomposition of Hankel matrices, *J. Magn. Res*., **114**, 120-123.

25. Jahn, S., Roggenbuck, D., Niemann, B. and Ward, E.S. (1995) Expression of monovalent fragments of human IgM autoantibody in *E. coli*. The input of somatically mutated CDR1/CDR2 and of the CDR3 into antigen binding specificity, *Immunobiol.,* **193**, 400-419.

26. Falcioni, F., Vidovic, D., Ward, E.S., Bolin, D., Singh, G., Shah, H., Ober, B. and Nagy, Z.A. (1995) Self tolerance to T cell receptor Vβ sequences, *J. Exp. Med.*, **182**, 249-254.

27. Rosloniec, E.F., Brand, D.D., Whittington, K.B., Stuart, J.M., Ciubotaru, M. and Ward, E.S. (1995) Vaccination with a recombinant Vα domain of a T cell receptor prevents the development of collagen induced arthritis, *J. Immunol.*, **155**, 4504-4511.

28. Fields, B.A., Ober, B., Malchiodi, E.L., Lebedeva, M.I., Braden, B., Ysern, X., Kim, J-K., Shao, X., Ward, E.S. and Mariuzza, R.A. (1995) Crystal structure of the Vα domain of a T cell antigen receptor, *Science,* **270**, 1821-1824.

29. Ghetie, V., Hubbard, J.G., Kim, J-K., Tsen, M-F., Lee, Y. and Ward, E.S. (1996) Abnormally short serum half lives of IgGs in β2-microglobulin deficient mice, *Eur. J. Immunol.*, **26**, 690-696.

30. Popov, S.P., Hubbard, J. G. and Ward, E.S. (1996) A novel and efficient route for the isolation of antibodies that recognise T cell receptor Vαs, *Mol. Immunol*. **33**, 493-502.

31. Popov, S.P., Hubbard, J. G., Kim, J-K., Ober, B., Ghetie, V. and Ward, E.S. (1996) The stoichiometry and affinity of the interaction of murine Fc fragments with the MHC class I related receptor, FcRn, *Mol. Immunol*. **33**, 521-530.

32. Medesan, C., Radu, C., Kim, J-K., Ghetie, V. and Ward, E.S. (1996) Localization of the site of the IgG molecule that regulates maternofetal transmission in mice, *Eur. J. Immunol*., **26**, 2533-2536.

33. Ober, R.J. and Ward, E.S. (1996) A system theoretic formulation of NMR experiments, *J. Math. Chem.*, **20**, 47-65.

34. Medesan, C., Matesoi, D., Radu, C., Ghetie, V. and Ward, E.S. (1997) Delineation of the amino acid residues involved in transcytosis and catabolism of mouse IgG, *J. Immunol*., **158,** 2211-2217.

35. Li, H., Lebedeva, M.I., Ward, E.S. and Mariuzza, R.A. (1997) Dual conformations of a T cell receptor Vα homodimer: implications for variability in VαVβ domain associations, *J. Mol. Biol*., **269**, 385-394.

36. Ghetie, V., Popov, S., Borvak, J., Radu, C., Matesoi, D., Medesan, C., Ober, R.J. and Ward, E.S. (1997) Increasing the serum persistence of an IgG fragment by random mutagenesis, *Nature Biotech*.,**15**, 637-640.

37. Kumar, V., Coulsell, E., Ober, B., Hubbard, G., Sercarz, E. and Ward, E.S. (1997) Recombinant T cell receptor molecules can prevent and reverse experimental autoimmune encephalomyelitis: dose effects and involvement of both $CD4^+$ and $CD8^+$ T cells, *J. Immunol*, **159**, 5150-5156.

38. Ober, R.J. and Ward, E.S. (1997) On the class of attainable multidimensional NMR spectra, *J. Math. Chem*, **22**,1-10.

39. Radu, C., Ober, B.T., Colantonio, L., Qadri, A. and Ward, E.S. (1998) Expression and characterization of recombinant, soluble peptide:I-A complexes associated with murine experimental autoimmune diseases, *J. Immunol*., **160**, 5915-5921.

40. Medesan, C., Cianga, P., Mummert, M., Stanescu, D., Ghetie, V. and Ward, E.S. (1998) Comparative studies of rat IgGs to further delineate the Fc:FcRn interaction site, *Eur. J. Immunol*., **28**, 2092-2100.

41. Borvak, J., Richardson, J., Medesan, C., Antohe, F., Radu, C., Simionescu, M., Ghetie, V. and Ward, E.S. (1998) Functional expression of the MHC Class I related receptor, FcRn, in endothelial cells of mice, *Int. Immunol*., **10**, 1289-1298.

42. Thatte, J., Qadri, A., Radu, C. and Ward, E.S. (1999) Molecular requirements for T cell recognition by an MHC Class II restricted T cell receptor: the involvement of the fourth hypervariable loop of the Vα domain, *J. Exp. Med*., **189**, 509-519.

43. Aroeira, L.S., Mouton, C.G., Toran, J.L., Ward, E.S. and Martinez-A, C. (1999) Anti-Vβ antibodies induce and maintain staphylococcal enterotoxin B-triggered Vβ8 cell anergy, *Eur. J. Immunol*., **29**, 437-445.

44. Qadri, A., Radu, C., Thatte, J., Ober, B. and Ward, E.S. (1999) Characterization of the interaction of a T cell receptor alpha chain variable domain with major histocompatibility class II I-A molecules, *Int. Immunol*., **11**, 967-977.

45. Ober, R.J., Ramakrishna, V. and Ward, E.S. (1999) On the role of reachability and observability in the analysis of NMR experiments, *J. Math. Chem*., **26**,15-26.

46. Ober, R.J. and Ward, E.S. (1999) The choice of reference cell in the analysis of kinetic data using BIAcore, *Anal. Biochem.*, **271**, 70-80.

47. Ober, R.J. and Ward, E.S. (1999) The influence of signal noise on the accuracy of kinetic constants measured by surface plasmon resonance experiments, *Anal. Biochem*., **273**, 49-59.

48. Cianga, P., Medesan, C., Richardson, J., Ghetie, V. and Ward, E.S. (1999) Identification and function of FcRn in mammary gland of lactating gland, *Eur. J. Immunol*., **29**, 2515-2523.

49. Kim, J-K., Firan, M., Radu, C., Kim, C-H., Ghetie, V. and Ward, E.S. (1999) Mapping of the site on human IgG1 for binding of the MHC class I related receptor, FcRn, *Eur. J. Immunol.*, **29**, 2819-2815.

50. Schuck, P., Radu, C. and Ward, E.S. (1999) Sedimentation equilibrium analysis of recombinant mouse FcRn with murine IgG1, *Mol. Immunol*., **36**, 1117-1125.

51. Qadri, A., Radu, C.G., Thatte, J., Cianga, P., Ober, B.T., Ober, R.J. and Ward, E.S. (2000) A role for the region encompassing the c" strand of a T cell receptor Vα domain in T cell activation events, *J. Immunol.*, **165**, 820-829.

52. Radu, C., Anderton, S.M., Firan, M., Wraith, D.C. and Ward, E.S. (2000) Detection of autoreactive T cells in H-2^u mice using peptide-MHC multimers, *Int. Immunol.*, **12**, 1553-1560.

53. Anderton, S.M., Radu, C.G., Lowrey, P.A., Ward, E.S. and Wraith, D.C. (2001) Negative selection during the peripheral immune response to antigen, *J. Exp. Med*., **193**, 1-11.

54. Kumar, V., Maglione, J., Thatte, J., Pederson, B., Sercarz, E. and Ward, E.S. (2001) Induction of a type I regulatory CD4 T cell response following Vβ8.2 DNA vaccination results in immune deviation and protection from experimental autoimmune encephalomyelitis, *Int. Immunol*., **13**, 835-841.

55. Firan, M., Bawdon, R., Radu, C.G., Ober, R.J., Eaken, D., Antohe, F., Ghetie, V. and Ward, E.S. (2001) The MHC Class I related receptor, FcRn, plays an essential role in the maternofetal transfer of gammaglobulin in humans, *Int. Immunol*., **13**, 993-1002.

56. Garcia, K.C., Radu, C.G., Ho, J., Ober, R.J. and Ward, E.S. (2001) Kinetics and thermodynamics of T cell receptor-autoantigen interactions in murine experimental autoimmune encephalomyelitis, *Proc. Natl. Acad. Sci. USA*, **98**, 6818-6823.

57. Machius, M., Cianga, P., Deisenhofer, J. and Ward, E.S. (2001) Crystal structure of a T cell receptor Vα11 (AV11S5) domain: new canonical forms for the first and second complementarity determining regions, *J. Mol. Biol*., **310**, 689-698.

58. Ober, R.J., Radu, C.G., Ghetie, V. and Ward, E.S. (2001) Differences in promiscuity for antibody-FcRn interactions across species: implications for therapeutic antibodies, *Int. Immunol.*, **13**, 1551-1559.

59. Qadri, A. and Ward, E.S. (2001) Activation of a T cell hybridoma by alloligand results in differential effects on IL-2 secretion and activation induced cell death, *Eur. J. Immunol.*, **31**, 3825-3832.

60. Deng, C., Minguela, A., Hussain, R.Z., Lovett-Racke, A.E., Radu, C.G., Ward, E.S. and Racke, M.K. (2002) Expression of the tyrosine phosphatase SHP-1 determines T cell activation threshold and severity of experimental autoimmune encephalomyelitis, *J. Immunol.*, **168**, 4511-4518.

61. Bäcklund, J., Treschow, A., Firan, M., Malmström, V., Issazadeh-Navikas, S., Ward, E.S. and Holmdahl, R. (2002) Reversal of tolerance induced by transplantation of skin expressing the immunodominant T cell epitope of rat type II collagen entitles development of collagen-induced arthritis but not graft rejection, *Eur. J. Immunol*., **32**, 1773-1783.

62. Ober, R.J. and Ward, E.S. (2002) Compensation for loss of ligand activity in surface plasmon resonance experiments, *Anal. Biochem.*, **306**, 228-236.

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66. Ober, R.J., Lin, Z., Ye, H. and Ward, E.S. (2002) Achievable accuracy of parameter estimation for multidimensional NMR experiments, *J. Magn. Res.*, **157**, 1-16.

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69. Ward, E.S., Zhou, J., Ghetie, V. and Ober, R.J. (2003) Evidence to support the cellular mechanism involved in serum IgG homeostasis in humans, *Int. Immunol*., **15**, 187-195.

70. Huang, J., Han, M., Minguela, A., Pastor, S., Qadri, A. and Ward, E.S. (2003) T cell recognition of distinct peptide-I-A^u conformers in murine experimental autoimmune encephalomyelitis, *J. Immunol*., **171**, 2467-2477.

71. Zhou, J., Johnson, J., Ghetie, V., Ober, R.J. and Ward, E.S. (2003) Generation of mutated variants of the human form of the MHC class I-related receptor, FcRn, with increased affinity for mouse immunoglobulin G, *J. Mol. Biol*., **332**, 901-913.

72. Cianga, P., Cianga, C., Cozma, L., Ward, E.S. and Carasevici, E. (2003) The MHC class I-related receptor, FcRn, is expressed in the epithelial cells of the human mammary gland, *Hum. Immunol*., **64**, 1152-1159.

73. Ober, R.J., Ram, S. and Ward, E.S. (2004) Localization accuracy in single molecule microscopy, *Biophys. J*., **86**, 1185-1200.

74. Hunt, L.R., Ward, E.S. and Ober, R.J. (2004) Approximation of trajectories of nonlinear systems by iterates of systems with linear state dynamics, *Systems and Control Letts.,* **51**, 377-381.

75. Huang, J., Vestberg, M., Minguela, A., Holmdahl, R. and Ward, E.S. (2004) Analysis of autoreactive T cells associated with murine collagen-induced arthritis using peptide-MHC multimers, *Int. Immunol*., **16**, 283-293.

76. Ober, R.J., Martinez, C., Vaccaro, C., Zhou, J. and Ward, E.S. (2004) Visualizing the site and dynamics of IgG salvage by the MHC Class I-related receptor, FcRn, *J. Immunol*., **172**, 2021-2029.

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81. Zhou, J., Mateos, F., Ober, R.J. and Ward, E.S. (2005) Conferring the binding properties of the mouse MHC Class I-related receptor, FcRn, onto the human ortholog by sequential rounds of site-directed mutagenesis, *J. Mol. Biol.,* **345**, 1071-1081.

82. Huang, J.C., Ober, R.J. and Ward, E.S. (2005) The central residues of a T cell receptor sequence motif are key determinants of autoantigen recognition in murine experimental autoimmune encephalomyelitis, *Eur. J. Immunol*., **35**, 299-304.

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